FARM FRIENDS
AND
SPRING FLOWERS

TEACHERS' EDITION

E. L. Crawford

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Brief Sketches of Western Plant and Animal Life useful to Man in the Rocky Mountains

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By J. H. PAUL, (*Plants and Insects*)
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AND
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Salt Lake City, Utah
THE DESERET NEWS
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Several Reasons

For Open-air Observation of the Ways of Nature.

Modern education aims to substitute first-hand experience in seeing, thinking, and doing, for reading about what some one else says he has seen, or known, or done. With the child this means, largely, the substitution of nature study for book study, of sense-training and direct inference for memory work, of activity in the open for inaction in the school room. The best form of the new movement consists in learning from observation the truth of things and the laws that govern them. With beginners, this can be better accomplished by the study of living, active beings than by a study of lifeless objects. We treat, therefore, as many of the forms of life—plant, bird, insect, mammal, Indian—as space permits, and, by briefer mention of other forms, point the way to further study. The larger edition contains a Manual, in which some topics are carried further and related ones are added. The facts are stated simply and concisely, but without any striving after child language, since teacher and pupil, or parent and child, are expected to use this book together. The bearing of the facts upon our own safety or profit has been indicated but not emphasized, since financial considerations, fortunately, make little appeal to child nature. The main purpose is to train the pupil to see, to know, and to appreciate. Nevertheless, to learn that most of the creatures that people commonly fear are not only harmless and friendly but useful and necessary; to overcome the common repugnance toward numerous animals which must be our companions all through life; to out-grow the dread which many persons—mostly from superstition and misinform—feel and manifest toward the harmless and marvelous caterpillar, the beneficial and valuable toad; to know that few spiders are poisonous, and that the bite of none is fatal; that not even the tarantula has jaws strong enough to pierce the skin deeply, and that the scorpion's sting is scarcely as dangerous as the sting of a bee; that most snakes are perfectly harmless and that there is no toad or frog that ever produces the smallest wart or does any other miscrief; that all our lizards except the rare Gila monster are harmless and beneficial, while horned toads are among nature's best gifts to agriculture; that dragon-flies, damsel flies, lace wings, ant-lions, lady-birds, and carnivorous and scavenger beetles, are among our best allies in the endless battle with insect plagues—such knowledge, were we disposed to argue, might be shown to be "useful" in more ways than other materials for teaching can claim to be. A writer in the Atlantic Monthly has said:

> "All the good smells, the wholesome smells, the healthy smells of life and labor were outside the great room. The smell of rain upon the grass, and of the flowers, consumed by their love for the stars. The heavy smell of smoke that coiled out of myriads of chimneys, of ships, and factories, and homes. The dry smell of sawdust and the salty smell of the iron filings. The odor of magazines and granaries and warehouses, the kingly smell of argosies and the rich scent of market places, so dear to the women of the race. The smell of new cloth and new linen, the smell of soap and water and the smell of newly printed paper. The smell of stables, the warm smell of cattle and sheep, that Virgil loved. The smell of milk and wine, of plants and metals. And all the good odors of the earth and of the sea and of the sky, and the fragrance of fresh bread, sweetest aroma of the world, and the smell of human sweat, most holy incense to the divine nostrils of the gods, and all the Olympian perfumes of the heart and the brain, and the passions of men, were outside of the great greenish room. But within the old room there was nothing but the smell of old books and the dust of things decayed, and the suffocated exhalation of old graves, and the ashen odor of dissolution and death."

One aim of nature study is to induce teachers to take their pupils, as often as possible, into the shade of the tall trees, there to get the odor of the grass and flowers, as a stimulant to the appetite, a tonic to the digestion, and a rest and inspiration to the mind; to get away from the dust of the city street, from the heat and the foul air of the crowded center, from the noise of pavements. The contrast between the air indoors and that of the open is probably greater in the Plateau region than elsewhere. Our atmosphere, owing to the altitude, is less dense and has an average of 20% less oxygen than the air at sea level contains. Oxidation of effete matter in quantity may be somewhat slower, the accumulation of unhealthful odors in crowded rooms more rapid, so that the air becomes more poiosnous with the same amount of breathering in the rooms or with the same degree of other conditions of decay and deterioration. Fresh air may be a luxury in some countries, but it is a necessity in places of high altitude. On the other hand, the writer has repeatedly noticed that the odors of the out-of-doors become more fragrant and perceptible with increase of altitude. This may be an illusion; but the scent of the sagebrush has no parallel in our experience, unless it be found in the still keener perfume of the fragrant sumach—the skunk-berry, or squawberry, of our region. In fact, the odors of the crushed foliage of a number of our plants are so strong that they are vulgarly known as stinkweeds. But there is nothing loathsome about these crisp and almost stinging scents; they are distinctly antiseptic; and whoever does not enjoy them seems, to our fancy, to be effeminate, and we may be tempted to call him a "mollycoddle." For whether it be rabbit brush or bee plant, Abronia, the sand-puff, with its orange-blossom fragrance, or the carmine gilia and the Jacob's ladders with their biting, alum-like smells; whether oak-brush or cottonwood, willow shrubs or torchweed, new-mown hay or sweet clover, each with its strong and penetrating odor—all of them smell good, for they bear the odors of life.

They catch the sense with a power that the natural vegetation elsewhere does not seem to attain; while the odor of moisture—even water-vapor seems to have an odor in the semi-arid countries—as it rises from the dashing stream of the mountain gorge in a barely visible mist and cools your reeking face in midsummer—do the favored moist regions possess any luxury of the out-of-doors that is like unto it? The clear stream whirls and bubbles here, or foams and sparkles there, and rushes on and on, while its dewy fragrance and freshness invigorate the air above it, and bring life and joy to the thirsty valleys below. In itself, it is a picture of life, one of the most glorious in uature—"a thing of beauty and a joy forever." Who in the progressive West would seek to deny to the child the right to learn nature's lessons from such sources as this? So, too, the smell of the soil in summer, after a rain, is one of the real joys of Western existence. It is said to owe its peculiar quality, different from anything else in nature, to the soil bacteria, which multiply in the ground at that time. It is, also, the odor of life; it has the flavor of growth, the feeling of power. Shelley has beautifully noticed how

"The snowdrop and then the violet
Arise from the ground by the warm rain wet,
And their breath is mixed with the odor sent
From the turf, like the voice and the instrument."

For whatever it is that produces this peculiar invigoration, it is certain that it is good to experience it. It is good to get away from the environment of factory or shop, of office or store, if only to take deep breaths of our spring or autumn air, which tingles with ozone and electrical potential and is redolent of the perfume of fruits and flowers. It is good for student or philosopher to lay aside for a day, at least, the reading of what other men say they have experienced of life, and to go out and experience real life for himself. Life is sustained from the outside, and is diminished in the precise proportion that it is shut up and restrained in the air-tight houses men have always been trying to build. Fortunately they have never succeeded in this misguided ambition. If they had, our race might have been all killed off ere this. But they could not build air-tight houses, and the houses are now being so built as to let in still more air and sunshine, and to let out still more of the death poisons, which are manufactured in them. In the reeking filth of the crowded "hives of men" the harmful bacteria multiply. Those that generate in the open are life-giving and fragrant. Odors that are evolved in the course of the dust and decay of the indoors are ill-smelling, and are laden with the germs of nameless plagues. But the smell of the out-of-doors in the open country is always a fragrant freshness. Even if it comes from the desert, where it is not laden with the perfumes of wild flowers, it is still pleasant and heartening. The breeze from the canyon, on the other hand, is a bracing tonic; while the breath of the mountain top enlivens the languid body, and puts the stamina of endurance into a man. It exalts the soul, fires the ambition, and, we suspect, purifies the ideals. Open air schools are now conducted in Europe. Nature study may lead to them here.

This line of work, we are inclined to add, furnishes the best known materials for training the perception, the judgment, the reason, and the motor activities of the child. While this work may "pay" better than some other subjects, the bare idea of gain, the economic relation, or mercenary aspect, so powerful as a motive in adult life, has not been obtruded to take the place of the child's wonder or of his curiosity to know. Whatever touches his life and is unique or beautiful, can be made the means of his education. We need not force upon his attention the fact that in all this work we are really training him for social service, and that this kind of knowledge has money value. Further, the work of the beginner in nature observation should be pleasant and fascinating. It should present what is attractive, friendly, and inviting. If anything repulsive is introduced, its beneficial and entertaining characteristics should be quickly brought to view. While these chapters deal largely with familiar objects, the use or novelty of the commonplace is developed. Interest is as well sustained by finding something new in things already known as by dealing with what is altogether strange.

Farm Friends and Spring Flowers.

Part I. Autumn Studies.

a. Well Known Plants and Little Creatures.

THE DANDELION.

A Flower Asleep.—Did you ever see the dandelion go to sleep? Every evening, near sunset, the scales of the big flower cup close over the yellow flowers. They are covered up by their little green quilts to keep warm during the cool nights. They are also covered up when it rains. For the dandelions close their eyes when the rain or the dew begins to fall. When the sun shines the dandelions open and the bees and butterflies alight upon them. They take about an hour to open, and an hour to close. They look like gold. Some fields have so many dandelions that they are like carpets with golden flowers. Some lawns look the same, and then the dandelions must be dug out. The root goes deep, and it must be pulled out or cut off an inch or two below the ground or it will grow again. When the dandelion grows in lawns and gardens, we call it a weed. When it grows on ditch banks, we call it a flower. When we gather its roots and make root beer from them we call it an herb. When we take its long seed stems for trumpets or when we make chains of them, the dandelion is the children's friend. When we watch its seeds, like little balloons, fly away in the air, we call the seeds flyaways. Each seed looks like a little umbrella, or parachute. Have you seen it fly? Which end is up? When it alights in soft ground, does it stand up or fall down? Why?

Flower Structure.—Look at the seed under a lens—it is wrinkled and sharp-pointed. The long umbrella handle lets the seed just balance the hairy top, so that the seed can stick into the soft mud and begin to grow there.

Notice the two-pronged fork at the top. That is called the style.

The hairs below will form the flying balloon by and by. All the little flowers stand on a platform that is nearly flat. Count how many flowers there are on one platform. The yellow strap is called the ray flower. All the flowers of the dandelion are ray flowers. They are covered by the cup of leaves every night and when it rains. This large cup is composed of many thin leaves or scales. They open and show the flowers when the sun shines. They close and protect the flowers at night. Each head of seeds is at the end of a long, round, hollow stem. Measure some of them—4, 6, 7, or even 12 inches long. Split one open. It is milky. All the herbs that have strap-flowers in heads have a milky juice. It is hollow. This makes the stem stronger. It can bend without breaking. It sways in the breeze, and the wind blows off the downy seeds. So they fly everywhere. But notice the flowers that have not gone to seed. They have no stems, or the stems lie on the ground. The flower keeps close to the ground, for they are very heavy. If they were on a long stem, as the seeds are, they would bend it to the ground. So the stem waits till the heavy flowers are grown before it grows much. The seeds need the stems, and the stems straighten out or grow just when needed. How wisely the dandelion is cared for! Everything comes just right for its needs. When the right time comes, the stem straightens up or shoots up in a few days, so that the wind will catch the little balloons and carry them everywhere. A poet has said:

"O'er land and sea I traveled wide,
  My thought the world would scan;
But wearily I turned and cried,
  Oh, little world of man!

"I wandered by a green woodside
  The distance of a rod;
My eyes were opened, and I cried,
  Oh, mighty world of God."

What do you think the poet saw that opened his eyes? Could it be anything more wonderful than the dandelion? I hardly think so.

The Cut Leaf.—But look at the leaves of the dandelion. Their edges are cut into great teeth—lion's teeth, for it is a dandy lion. But why are the leaves cut so? Each top one lies above others, and would take nearly all the sunshine if it were not thus cut. For this reason the under leaves are cut little or not at all, while those above are cut and incised a great deal into lobes and teeth that let the sunshine reach their neighbors. The dandelions seem to think. They send their long roots so deep into the soil—sometimes a foot deep—that they find the moisture if the soil has any. This kind of root, so thick and undivided, is called a tap-root. When you cut this plant it seems to bleed. This juice is very bitter and gummy (taste it), and so the cows and horses and sheep will not eat many of them. This bitter juice is the dandelion's defense against being eaten by grazing animals.

Why Plants Succeed.—Why does the dandelion succeed so well where other plants fail? (1) Its dense mat of leaves shades the plants that are nearest by and they perish for lack of sunlight. (2) It begins early in the spring—like any good farmer—and never stops working till snow flies again. (3) It sends its tap-root so deep that it finds food and moisture in the soil that other plants fail to get. (4) In the fall its leafy rosettes protect the crown of the root all winter, so that it is all ready for an early start as soon as the snow has gone. (5) It has so many seeds, each able to fly, and each covered with a hundred little barbs all pointing backward, so that it sticks fast to any moist soil that it alights in. (6) It is not particular as to the kind of soil it grows in. (7) It is on good terms with many insects, which fertilize its seeds and make them stronger and more able to grow. Each little flower banner overflows with nectar when it first opens, and the insects swarm to the feast of honey-dew. The little bees are all dusty with yellow dust—the pollen—that falls on the two-forked part of the flower (the stigma) and fertilizes the seeds. But if the bees fail to do this work, the dandelion does it for itself, and its seeds grow anyhow. The outer banners unfurl first, a row at a time. The inner rays are last to open. Thus there are enough open all the time to keep the bees coming and going, and so they carry the pollen from one flower to another. At last, after all the florets have opened, they retire again into their greenhouse and work at perfecting the seeds. The doors are shut, no insects enter, the green blinds are drawn tight, and the work goes on within for several days. Then again the heads open, and disclose the white, fluffy balls of silvery balloons, which go sailing on the wings of the wind to distant places. Soon they have all flown. Often the gold-finch or pine siskin have eaten them from some of the heads, and they stand as bare and dimpled flat wheels at last.

With locks of gold today; tomorrow silver gray;
Then blossom-bald.

REARING BUTTERFLIES AND MOTHS.

Butterflies.—Half a dozen girls of the Fourth Grade came hurrying to my home one morning, with something in boxes.

"Oh! Professor, see what we have found."

"Twenty large, black caterpillars!"

"They were on the willow bushes, and in the elm trees, and among the hop vines."

Each was decked with tufts of black hair in rows along the body.

"Shelley gathered four of them into this pasteboard box."

"Helen picked some of them up in her hands."

"We are not afraid of them. They will not bite. They eat the willow leaves, and crawl up the trees. Our teacher told us that they are the baby butterflies. We thought you would like to have them, so we put them into these small boxes and brought them to you. What will you do with them?"

I told the girls that I would put them into chalk-boxes with wire screens over the top, so that the baby butterflies should get plenty of air. Then the girls could feed them every day with willow-leaves and hop leaves till the caterpillars grew large and would try to get out of the box. Then, I said, we could let them out and watch what they would do.

So we put them into the chalk-boxes with wire-screen covers. The girls brought willow leaves and hop leaves and put the leaves into the boxes for the baby butterflies to eat. The caterpillars ate the leaves and grew and grew till at last their skin got so tight that it began to burst open. The skin of the largest caterpillar began to crack and to split down the back. It seemed to be asleep. After it had been quiet and had lain quite still for three hours, it began to wake up. The crack in its skin down the back was now wide open, and the caterpillar began to come out of the crack. It first pushed its head out and looked around. Then it pushed its feet over the edge of the old skin and drew itself right out. The old skin was like a husk or shell. Next morning the shell was gone. Perhaps the caterpillars had eaten it. Some caterpillars eat the old shell or skin, so that birds or toads will not see it and then look for the caterpillar. Birds and toads eat up all the caterpillars they can find. So the caterpillars keep out of sight in the daytime, by hiding under the leaves.

In a few days the caterpillars had grown to be 2¼ inches long, and had stopped feeding. We opened the lid and they crept out and climbed the wall of the house till they were all on the ceiling of the porch. Each one we saw on close view to be black, frosted with white, with a row of 8 red spots along the back. They had 6 true legs in front and 8 false or prop legs, of red skin toward the rear of the body. The last pair of prolegs were now fastened to a button of silk glued to the ceiling, and they all hung head downwards before the day was over. Next day the skin had been shed for the last time, and a pretty, irregular shell of violet-brown color was hanging there, with a row of sharp-points along the back There they hung for about two weeks At last, one fine morning in June, we saw several large, black butterfliese with cream-colored border around their wings, clinging to the empty cases. Others came out a day later. They were the mourning cloak butterfly, and we kept the empty chrysalid shells as specimens. This butterfly comes out early in spring and is seen flying till late in the fall. Every caterpillar that can be found should be saved and fed on the leaves on which it was feeding, to see what it will turn out to be. On the cabbage we shall find green "worms"—"larvæ" is the true name—which will turn into white butterflies; on alfalfa and clovers are the caterpillars of orange -or lemon-sulphur butterflies, the yellows; on hop vines occur the larvæ of the beautiful violet tips—the fawn, the zephyr, the satyr, and the interrogation butterflies; on the hollyhock is another fine species; on the thistle, the larva of the painted lady and Hunter's butterfly; on willows, the large, smooth, big-headed, spectacled larvæ of black and yellow swallow-tails; on the poison parsnip another swallow-tail; on the milkweed, the larva of the grand reddish-brown monarch butterfly; on violets, the future silver-spots. The feelers, or antennæ, of butterflies, have a little knob at their end.

Moths may be reared in the same way. Moths have various kinds of antennæ, feathery, flat, thread-like, but never clubbed or knobbed at the end. On willows and currant bushes the larva of our finest giant silkworm moth is found—is the Western cecropia, called Samia gloveri.

Glover's Samia is often found; it is pale green with red, blue, and yellow spines, and becomes 4 inches long. The large, brownish cocoon clings to a branch. The brown-gray moth expands 5 or 6 inches, or more. It will feed on cuttings of willow and currant bushes thrust into jars filled with wet sand, and will fasten its cocoon to one of the limbs. Fine cheese cloth should be put over the cocoon to save it from small flies that lay their eggs in it.

Woolly bear caterpillars become moths of various kinds. The bodies of the larvæ are densely clothed with soft black hair, some kinds with some yellow. When fed in cages, they finally strip off this hair and weave it into their cocoons, into which they finally creep. Here they change, first into smooth chrysalids, later into moths.

The Tomato Worm is an enormous green and black caterpillar that feeds on the leaves. It is a formidable-looking "worm," nearly as thick as one's finger and about 3¼ inches long. It has a "horn" at the rear end of the body and eight marks—triangles—open at one end along each side. Capture one of these larvæ when nearly full grown and feed it on tomato foliage. Have it in a box containing six inches of sandy soil. The larva will finally burrow into the soil and transform into a jug-handled pupa 2 inches long. It stays in the ground all winter, the "jug-handle" serving to hold its long tongue, and then comes out in May as the well-known humming-bird moth which hovers about the flowers at dusk. The moth has a wing expanse of nearly 4 inches, and is pale brownish gray in color, with four dull-orange spots on each side of its abdomen, the hind wings marked with zig-zag lines. Eggs are laid on tomato or potato vines, hatch in from 4 to 8 days, and the caterpillars are full grown, after moulting four times, in a month.. Then it burrows into the earth, and the dark, mahogany-brown pupa is frequently plowed up." The willow sphinx moth is a beautiful and similar species not quite so large.

The Breeding Cage.—Let us go out to the willow-patch. At first all the leaves look alike, but we soon find one with a fine green caterpillar tied to it with silk. We cut off the limb and bring it in. Certain leaves are found fastened together with silk and the caterpillar is feeding near this cozy night-house. Some are roped together and the caterpillar is inside. Hop vines and hollyhocks contain fine specimens. Some of the chrysalids we shall enclose in netting, and watch for the butterflies to come out. We can feed the caterpillars in glass jars, which must be rinsed out and dried every day. A large wooden cage with glass sides is still better. A baking-powder can with a hole or two in the cover will answer, but it must be washed out daily, after carefully removing the caterpillars. A chalk box with a square hole cut in the lid, and the hole covered with a screen wire net, does very well as a breeding cage. Each caterpillar must be fed on the kind of leaves it was feeding on when captured, and the leaves should be kept on twigs thrust into wet sand in a flower pot. A lamp chimney placed on the pot and enclosing the leaves, makes a good cage into which all actions and changes can be clearly seen.

THE CALIFORNIA POPPY.

Planting.—We planted our California poppies in April. The boys dug the land, and all the pupils joined in raking and mulching the surface, till it was smooth and fine on the top without any lumps. Then very shallow, wide, flat furrows only an inch deep were made, and the seed was scattered along the furrows. Sand and fine soil were sifted over the seeds, and gently pressed down with a board. In a short time the poppies were up and made a fine growth. Some of them flowered the first season; but the second summer, till far into autumn, the bed was a mass of golden color.

The Name.—Early Spanish settlers on the Pacific coast gave to these brilliant wild flowers the appropriate name of Copa-de-oro, meaning cups of gold. Later the plant was named by botanists the Escholtzia, from a German, Escholtz, who visited California in the 19th century as a member of a Russian exploring expedition. His admiration for this beautiful flower caused it to be named after him. The foliage is mostly a pale blue-green, fern-like in the five main and many smaller divisions of the leaf, smooth and shining. Long flower-stems (petioles) bear the handsome flowers, which are deep yellow, like the gold of California, in its native hills and deserts; or pale yellow, like the gold of Australia; or even white, as it loses its rich hues in our gardens.

If you examine the bud, you will find it covered with a thin membrane of silk—a snug, close-fitting cap, which keeps out the rain. As the flower opens, this cap is forced upward till it is free from the rim at the bottom of the flower from which it grew, and the growing petals carry it higher and higher till at last it falls off; then the flower spreads out in a golden cup to catch the sunshine and to attract the bees. This peaked cap resembles the toboggan caps which the brownies wear, and is composed of two parts, or leaves, joined by a fine seam. After this odd little cap falls off, we cannot find the sepals, and the pupils may think there are no sepals here; but the brownie cap was formed from the two sepals that were cut from the rim and thrust off by the expanding flower.

Structure.—The curious manner in which the petals fold around each other is also a study in mechanism; for the outer petal enfolds all the others as closely as it can, while its mate within it enfolds the other two; the inner two are wrapped around the stamens to protect their precious gold dust till the flower flares wide open and the pollen is ready to be scattered. So, too, at night and on cloudy days the petals close again around the tender stamens to keep them warm. There are many stamens. The top part of each, the anther, is large, and the stalk or filament that holds them up is very short. When ready to open and shed their abundant pollen on the visiting bees, the stamens spread out into the form of a many-pointed star. Sometimes each petal closes around the group of stamens nearest to it, and insects may be sheltered in this cozy, night-formed tent, with plenty of pollen for supper and breakfast. Notice how fast, when the petals have fallen, the pod grows into a long, grooved, and twisted seed box, which finally may be opened lengthwise and the tiny seeds collected for planting.

—California poppy.

ASIATIC AND CALIFORNIA POPPY.

A native of the sand hills, this plant is well adapted to endure our long, dry, rainless summer. Its long, smooth tap-root goes deeper and deeper, till at length it is independent of irrigation. It is therefore one of the best species for planting in school gardens throughout the Plateau, especially in the drier parts. When once started, it needs no re-sowing, because its long roots at length find the water that is deep down in the soil. It averages about a foot in height, and the bushy foliage is silvered with a fine coat of short hair. It bears flowers till the frost comes in the fall. Like its cousins, the cultivated popies, the flowers consist of two sepals, four showy petals, many stamens, one seed-pod, and many small seeds.

THE CUP OF GOLD.

"I found it and left in its place,
The sun-born flower in cloth of gold
That April owns but cannot hold
From spreading its glory and its grace
On months that always love it less,
But take its alms in their distress."
—Irene Hardy.

The golden poppy is God's gold,
The gold that lifts, not weighs us down
The gold that knows no miser's hold,
The gold that banks not in the town,
But singing, laughing, freely spills
Its hoard far up the happy hills;
Far up, far down, at every turn—
What beggar has not gold to burn!
—Joaquin Miller.

THE PRICKLY POPPY.

Flower.—The large white flower of the prickly poppy may be found on the tops of stout bristly stems one to three feet high in the fall or late in summer, as well as earlier in the season, in most of the Plateau region. The flowers are large and lily-like, glistening like fine silk or satin in the strong sunshine. They are clear white, or in some kinds pinkish. The stamens are very numerous, and with their yellowish anthers give a rich mass of fringe-like material that surrounds the pistil as if to keep it warm in its earlier stages. The sepals are only two or three in number, and like those of other poppies they fall very early. The sepals are covered and edged with numerous stiff (hispid) bristles that are not strong enough to be called prickles. The petals are four or more, and these also last but a few days after the flower opens. The flowers are so short-lived that if they were less showy they might fail to receive the visits from the bees and other insects necessary for their pollination. As it is, they have plenty of insect visitors during their short period of bloom.

Desert Plants.—Unlike the cultivated poppies, which sprinkle out their seeds through small pores in the top of the pod, the four parts of the capsule of the prickly poppy split apart, and scatter the seeds in this way. And while the garden poppies have a dainty, bold and airy aspect of peculiar grace, from the slender stems, sparse foliage, and nodding flowers, the prickly poppy has a rigid, bristling appearance peculiar to the plants of the desert or arid regions. The very look of this plant shows its warfare with desert life. The tough, bristly leaves, armed with spines and filled with a yellow, bitter sap, protect it from being eaten to any great extent by animals, and also reduce the amount of evaporation from the leaves. The lobed leaves, instead of growing out into long divisions, turn into strong spinous bristles at the tips. Now, bristles have no such tendency to evaporate water as leaf lobes possess; and the yellow juice within clogs the leaf-pores on the inner side. Thus the water that is found by the long root is not transpired easily through the lessened leaf surface, which is cemented on the inside by the yellow sap. Many of the leaves are marked with white blotches in one of the species. Neither the cause nor the use of thse spots has been suggested. The foliage is covered with a fine white powder, which rubs off easily, but serves also to reduce evaporation from the leaves. The yellow juice would probably yield opium, as would also that of the sister species found in sandy valleys. One true poppy, the alpine, a small plant of high mountains, has yellow petals; and this one also has a narcotic white sap. Other plants that have only two sepals and four petals are the Dicentra or wild bleeding-heart, with flesh-colored flowers shaped somewhat like those of the bleeding-heart of the gardens, and found only in the high mountains; and the Corydalis, of several kinds, with the two outer petals spurred. Three of the latter have golden yellow and a fourth white or cream-colored flowers. Garden poppies of any kind and the cultivated bleeding-heart should be compared with these wild flowers.

THE STORY OF QUEEN CLOVER.

History.—A big, common, wild plant is the finest farm-helper of all—the sweet clover. It grows tall and rank along streams and roadsides. People call it a native weed. But it is not a native, and is no weed, but a real farm friend. It was brought here in early times as forage-food for yoke-oxen. In those days cattle were tamed and drew wagons across the plains before railroads had been built to the Rocky Moutains. Some of these wagons were of immense size, shaped like boats on wheels, and called "prairie schooners." They carried many tons of freight and from four to ten yoke of oxen drew them over the hills, through streams and mud. When the wheels went down into a deep chuck-hole, the driver would speak to his oxen and they would bend close to the ground; then they would put their feet forward, and as the long whip cracked over their backs they would rise all at once and either pull the wagon out or pull it apart, for they were very strong. It was not possible to carry food for the cattle in the overland wagons, and so these patient animals had to find their own food every night after they had been unyoked. This they managed to do very well, for the plains were grassy, and much vegetation covered the banks of streams. There were so many trains of wagons, drawn by so many yoke of cattle, however, that the grass within reach of the trails was soon eaten off. Then it occured to some of the bullwhackers, as the drivers were called, to strew the seed of the white sweet clover along the route, and soon the plants were growing by the sides of the strams. The cattle were very fond of sweet clover, and they thrived well upon it. Clover has in it a great deal of the fine food substances called nitrates, which are necessary for the formation of muscle; not only in animals, but in our own bodies. Did you ever hear of "pigs in clover?" Why should pigs be found in clover? The bees also love the sweet clover. Can you guess why?

Thrift.—The sweet clover managed to thrive on the poorest soil, where most other useful and even useless plants failed to find a living. Waste places became covered with its beautiful dark-green foliage, giant stems, and white, fragrant honey-flowers. The desert blossoms where the clover grows. Sweet clover has long roots; they go deep into the soil in search of moisture. The roots die every two years (sweet clover is a biennial) and thus let the air and rain go far down into the ground. These make the soil fertile. Flood water also gets into the openings made by the roots, and soon makes the poor, barren soil fit for growing good crops. The air and moisture prepare the plant food that is already in the earth, and make it ready for the use of the planted crops. But the clover roots do still more, and render a still greater service. All clovers are rich in nitrates. These are substances much needed by all plants, as well as by men and animals. As the clover roots decay, they add nitrogen to the earth, and nitrogen is just the kind of food that barren soils lack in dry countries. So, if the clover is plowed under, it will add still more of the nitrates to the land as it decays in the soil. Even if it is cut and left lying on the ground, the rain and snow will carry a great deal of its fertility into the soil, and the foliage that lies on the ground will keep the moisture from escaping from the soil. If sweet clover is grown on soil that contains some alkali, it helps to take out the alkali besides enriching the soil for other crops. Sweet clover, therefore, is a true and valiant pioneer, like those who brought it into the West. Like them, it makes a living in barren places and prepares the way for less hardy ones to follow. Most useful of all the weeds, it ought to be crowned the queen of wild flowers—a true princess of the desert places. All hail, and three cheers for Queen Clover! We shall be glad if her lucky-three-leaved children spring everywhere along our water ditches. They come swimming along in little seed-boats, and right welcome shall they always be.

Yellow sweet clover is like white sweet clover except that the flowers are yellow instead of white. Both resemble but may be distinguished from alfalfa by smelling the crumpled leaves, those of sweet clover resembling the odor of the tonka bean. These clovers are offensive to cattle, which may be trained to eat them. Valuable to plow under for enriching the land; seeds used to adulterate those of alfalfa; introduced from Europe. The order to which clovers belong is the pulse family Leguminosæ, with 7,300 species, second in size to the sunflower family. These legume or pod plants furnish the greatest number of useful plants. So far as known, but few plants outside of this family possess roots which furnish abodes for microbes through whose operation free nitrogen becomes plant food. These abodes are familiar objects on roots, and are known as tubercles or nodules. The plants of greatest value are the clovers, the alfalfa, beans, peas, lentils, lupines, vetches, cow peas, and soy beans. In this order are found plants of great importance for furnishing medicines, timbers, dye stuffs, gums, for beauty of flowers and foliage. It furnishes a very small number of weeds.

Structure.—All the clovers have three leaves—three in one; but the leaves of each clover are different from those of any other clover. Whoever can name several points of difference between the leaves of alfalfa, red clover, little yellow clover, white lawn clover, and wild white or sweet clover has good eyes and can compare and reason. A three-leaved clover called the Shamrock is the emblem of Ireland. When an early preacher, St. Patrick, first preached to the people of the Emerald Isle, and explained to them the doctrine of the holy trinity, an impudent dunce kept arguing that three persons could not be one. The preacher picked up a three-leaved clover and soon silenced the objector.

"When fields have lost their lingering light,
And paths are dusky through the night,
The clover is too sweet to lose
Her fragrance with the gathering dews,—
  The skies are warm above her;
The cricket pipes his song again
The cows are waiting in the lane,
The shadows fall adown the hill,
And silent is the whippoorwill;
But through the summer twilight still
  You smell the milk-white clover."
—Dora Read Goodale.

SWEET CLOVER. THE TEACHER'S STORY.

White clover lifts her dainty spears, or spikes, of little, shining flowers far above the ground, as far as possible from the crawling larvae that seek to devour them. The flowers need plenty of air and sunlight, and the branches spread wide and stand high for this reason. Most of the young caterpillars, also, would get discouraged before they could climb to the top of the long stems that lift the little flowers so far away from their enemies. The stems are like sticks, and are so dry, tough, smooth, and hard that the little larvae could not bite into them. The stems live two seasons, then bear flowers and seeds, and wither away. If the white clover is cut early in the year the first season, it makes good, tender hay. The numerous little blossoms have each a drop of honey in them, and the bees swarm over the blossoms in order to get the honey. The sweet clover has as much need of the bee as the bee has of the sweet clover. For the bee is a dusty fellow—sprinkled with a yellow dust from the clover blossoms. This gold dust is called pollen. It is necessary that the pollen be carried from one flower to another in order that the seeds shall grow well. The pollen comes from little sacs that surround the top of the tiny seed-pods. The bees serve the flowers by carrying the pollen grains. The flower serves the bee by furnishing for it a drop of honey dew in each blossom. Each serves the other, and each one gains by the service it renders to its friend and helper. On every warm day all through summer and autumn, the bees keep going on a perpetual visit to their friends the clovers. The clover wants them to keep coming and going from one flower to another, and so its blossoms do not come out all at once, but just one or a few at a time. The lower flowers open first, and then those higher up, as the stems grow longer and longer. The stem that bears the blossoms is at first a tiny bud between the main stem and the leaf (that is, it is in the axil of the leaf). There the tender bud is kept warm till it is strong enough to shoot out for itself, and then it grows quickly. The flower buds are close together at first, but the flower stem quickly separates them by growing longer. The lower buds are the first to open into flowers, the bees visit them, and more open from day to day. The stem grows at the tip, and new blossoms keep forming on fine days long after the earliest frosts have killed most other flowers. If you study the blossom carefully, you will discover that it is like a very small sweet pea. Not only is the blossom sweet with honey and very fragrant, but the leaves and stems have a sweet odor also, especially when drying. And whenever we come near to a patch of sweet clover in summer, we perceive that the air is laden with a sweet odor. The poet Shelley fancied that the winds were thieves stealing the odor of the rose, till they grew faint from their heavy burdens of sweetness:

> "Like a rose embowered in its own green leaves,
> By warm winds deflowered, till the scent it gives
> Makes faint with too much sweet these heavy-winged thieves."

And so it is with the dense richness of perfume cast by sweet clover. It seems to overload the breeze with its fragrant, new-mown hay odor and its suggestions of honey. Pleasing, hardy, and useful, this most beneficent plant is of more use to the farmer than it is even to the bees, the pigs, and the cattle.

The Farmer's Story.—A report, interesting to fruit growers, came in 1912 from Colorado. We have seen that wild sweet clover has several strong points in its favor, as a fertilizer of barren lands; peach growers in Colorado claim that the planting of **red clover** in a peach orchard **is fatal to the trees.** They say that any man who persists in growing red clover in his peach orchard for two consecutive years might as well say goodby to his profits. The trouble is not due to the absorption of moisture through the clover crop; for the effect is the same when great quantities of water are turned in. Trees among the red clover in 1912 are said to have made only two inches of growth, and looked spindling, and yellow; they were plainly sick. Sweet clover, on the other hand, is reported as having done no harm to the trees, and has proved the very best green fertilizer that can be grown in an orchard. "Alfalfa is not so bad in a grown orchard," says the farmer, "but red clover—never." Much of modern agriculture depends simply on the fact that **clovers are rich in nitrates.** They are a necessary part of crop rotation, and make good fertilizers. Soil experts say that any land that is idle because it is worn out may be increased in fertility by simply growing sweet clover upon it. Idle land is improved by growing plants on it that have the power to change the nitrogen of the air into the form of nitrates in the soil. There are several species of clovers and other plants that might be used for improving land. And since the sweet clover is the easiest to grow and happens to be one of the most beneficial as a fertilizer of the soil, we should grow it here.

ROSES, WILD AND CULTIVATED.

The rose is the finest of all the garden flowers cultivated for ornament. It is beautiful, fragrant, lasting, of many varieties, with different colors, sizes, times of bloom, and methods of growth. It is the one universal favorite, grown in all countries where it will thrive. Ours is not a rose country, being too dry; yet the rose is much cultivated here; and whenever it receives good cultivation, pruning, plenty of water for irrigation at just the right time, and is properly defended from its chief insect enemies, this beautiful flower does well in the gardens in the Rocky Mountains. The best time to plant the rose varies with the locality and with the variety of rose chosen, and should be learned from the local florist. To study the rose it will be best to go into the field or upon the hills near some spring or stream of water, and there collect its branches.

The red berries on the rose branches in fall are not fit to eat, but make pretty ornaments among green leaves for the mantle. They contain many silky seeds, which may be seen from the throat of the little urn that forms the berry. This urn is the calyx of the flower, which has grown over the seeds; this calyx is said to be superior to the pistil. That is, the calyx, or green flower-cup, grows upon the fruit and becomes part of it. The leaves of the calyx form a five-rayed star at the top of the red berry, and the seeds within the calyx berry are hard and shiny when stripped of this silky fur, which covers and keeps them warm and dry during the long winter. Birds feed upon the seeds all winter. If any seeds are left in the spring, they fall to the ground and may start new plants.

The leaves are divided into several smaller leaves called leaflets, which are always of an uneven number, with an odd leaflet at the tip. Then there is a pair of small leaves at the base of the leaf-stem and fastened to it. These are called the stipules. The bushes are large shrubs, often prickly, the foliage with glands that contain fragrant resin or gum. Some kinds, as the sweet brier, have a very pleasant odor about their leaves and stems. We notice the fine colors and delicate perfume of the wild roses, and observe that the stamens are very numerous. If we remove the wild roses to our gardens and cultivate them, some of the stamens change into petals. All the stamens may be changed into petals, and the double rose is produced. Double roses produce no seeds, and must be propagated from cuttings, as the gardener will explain. Some wild roses bear hooked prickles; others, as the early wild rose, called Rosa blanda on that account, are nearly unarmed. Some roses have only three or five leaflets, others, from five to nine; the leaflets are of various shapes, mostly elliptical or oval, and are sharply saw-toothed along the edges.

A celebrated painting portrays the birth of the red rose from the drop of blood that issued from the thorn-pierced foot of Venus,

> "Which, o'er the white rose being shed,
> Made it forever after red."

The Moss Rose is the rose most prized for its beauty. A rich mossiness surrounds the deeply colored flowers, and gives them a luxuriant appearance not easily described. A German writer has given the following explanation of the origin of this mossy vest:

"The angel of the flowers one day beneath a rose tree sleeping lay—
That spirit to whose charge is given to bathe young buds in dew from heaven.
Awakening from his slight repose, the angel whispered to the rose,
'O fondest object of my care, still fairest found where all is fair,
Ask what thou wilt, 'tis granted thee.' Then said the rose, with deepened glow,
'On me another grace bestow.' The angel paused in silent thought—
What grace was there the flower had not? 'Twas but a moment—o'er the rose
A veil of moss the angel throws;—and, robed in nature's simplest weed,
Could there a flower that rose exceed?"

Can you explain the meaning of these lines?

"Go, lovely rose! tell her that wastes her time and me
That now she knows, when I resemble her to thee,
How fair she seems to be."
—Waller.

"Wild rose, sweet-brier, eglantine,—all these pretty names are mine;
And scent in every leaf is mine, and a leaf for all is mine;
And the scent—'oh, that's divine!' happy-sweet and pungent fine,
Pure as dew and picked as wine."
—Leigh Hunt.

Such phrases as "rosy clouds," "rosy dawns," "as soft as a rose leaf," "as sweet as a rose," are expressions so familiar that they have almost become the language of daily life.

The wild rose, in all ages, has been made the emblem of nature's sweetest simplicity. It is loved not only for its fair and delicate blossoms, but also for its fragrant flowers and leaves, which, in the case of the sweet brier, daintily perfume "the dewy morn" and scent the soft "breath of evening."

Rose Family.—Roses stand at the head of the plants called exogens, or outward growers—those in which there is a distinct zone of wood, another of bark, and in the centre of the stem a cylinder of pith. The flowers of this great division are in fours or fives—4 or 5 petals and sepals, and the leaves are net-veined. The flowers of the order Rosaceæ have from five to many stamens, and from one to many pistils. The roses therefore include not only the rose proper but also the beautiful spireas of our lawns and gardens; the hawthorn, planted for hedges; the strawberry, raspberry, and the blackberry; and also such fruits as the peach, almond, plum, cherry, and nectarine, which have stone fruits called drupes, as well as the apple, pear, etc., which have fleshy fruits enclosing small seeds in cells or compartments within and called pome fruits. As in the wild rose and sweet brier, the leaves of all the family are arranged in alternate order around the stem, and never opposite; their flowers are regular and showy, the five petals being inserted on the calyx. Facts similar to those discovered in the rose may be found in blossoms of the apple, the pear, the peach, plum, apricot; also the strawberry, raspberry, service-berry, choke cherry, and other fruits. The leaves may be drawn, or pressed and preserved; and samples of the wood and bark may be preserved for comparison of the different kinds.

A SOIL MONOPOLIST—THE GREEDY BURDOCK.

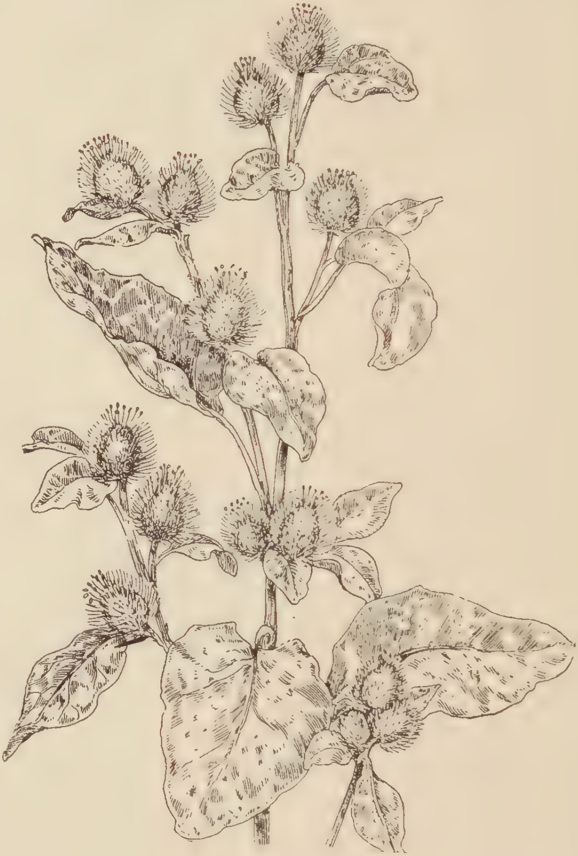
Two giants of the weed world that are very much alike in several respects, though different enough in others, are the burdock and the cocklebur. They infest most parts of the country to the vexation of all people and inflict special losses upon the flockmaster and the agriculturist. Burdock, a native of Europe, was brought in as a medicine, its dried roots being considered a good blood purifier; but the cocklebur seems to be a native of all the Western country. Both develop the large and numerous burs that plague the animals as well as the people, and both should be promptly exterminated wherever they appear. It is against the law to permit either of these weeds to go to seed upon one's land, and school pupils should assist in the work of exterminating them. One use, however, to which these coarse weeds may be put is that of furnishing excellent materials for school lessons. In this sense, we may regard them as friends.

Structure.—We can see from its flower-heads that burdock is a member of the composite or sunflower family, though it has only the inner or disk florets. It lacks the outer or ray flowers that give beauty to the sunflower and aster. The florets of the burdock are of a purple color. They are almost hidden within the turnip-shaped involucre. This flower cup, though it has a dainty shape, is a bur craftily constructed for stealing a ride. It is also a fortress of defense against the insects and browsing animals that would eat the seeds. This bur clings to the fur and wool of animals and to the clothing of people; and has often been known to ensnare the pretty goldfinch. The wild canary gets caught by the cruel little hooks. This useful song bird, seeking the seeds of the bur, flies to the masses of brown burs when they have ripened in the fall. As it flutters about them, the fine down beneath its wings becomes entangled in the hooks of the bur, and the more the bird struggles the more the feather-down becomes entangled till the bird perishes from exhaustion and hunger.

> "How couldst thou, Mother Nature, to whom we all belong,
> Betray our little brother, he of the bright wings and song?"

But if Mother Nature or any one else is sorry for this, the burdock is not; it does not care—does not even know.

A Selfish Plant.—Burdock is selfish and greedy, showing its true nature in early life. As soon as it comes out of the ground, it spreads far out its broad, thin leaves and they shade and destroy any other plants growing there. Some one has said that all young things are selfish; and this is certainly true of the young burdock. For its leaves, growing faster than those of any of its neighbors, cut off from them the light and warmth. But while they dwindle and die, the burdock is careful not to shade its own broad leaves. It gives to the first leaves that come out stems so long that they reach beyond the shadow of the leaves that come out above them. The lowest leaves are thus the longest and largest, those next above are shorter and smaller, and so on to the very top. The youngest top-leaves are but an inch or two long, while those at the base may be a foot or more in length. Thus the plant is shaped like a broad pyramid. Often it is several feet high and nearly as broad as tall. There is no sweetness about the burdock, and farm animals will not eat its bitter foliage. Very small worm-like animals—the larvae of certain moths—sometimes eat out the green tissue of the leaves; they spare the frame-work, and so are said to skeletonize the leaves. No other animals seem to touch the burdock, so that it covers the ground unmolested. The lower leaves are somewhat heart-shaped in outline, the upper ovate (egg shaped); they are veiny, green above, and covered with a felty, white wool on the underside. Thick, stout branches rise from the main stem. Those at the base are at an angle of 90 degrees—they lie flat; the next higher are lifted at a polite angle, so as not to stand in their light. "This courtesy characterizes all the leaves of the plant, for each higher leaf has a shorter petiole which is lifted at a narrower angle from the stalk."



Top flowers and leaves of the smaller burdock. The one commoner here has larger burs. Neither has any ray flowers, the purplish disk flowers scarcely showing. The leaves of the larger are whitish cottony beneath, the upper egg-shaped, the lower heart-shaped and sometimes a foot long. The "wires" are turned inwards at the tip; these are the hooks that ensnare the goldfinch. These little "wires" are the altered leaves or scales of the involucre—the flower cup that resembles the calyx of single flowers of other orders.

Other Details.—The petioles (leaf stems) are margined in order to get still more sunlight and to cut off the light from plants below. The leaf stems expand at the base and "grasp the stems on both sides with a certain vicious pertinacity which characterizes the whole plant." The cup that contains the head of flowers—the involucre—is smooth and ball-shaped, with a tapering apex that causes the head to resemble a turnip or an onion. The leaves that form the cup have been changed by this crafty plant into tough little wires, so that stock will not eat them. Curious little hooks at the ends of the "wires," enable the burs to cling to the fleece of animals. The hooks turn inward and are very sharp. They serve the burdock well; they get the seeds carried by animals to distant places, where they may have better chance to take root and grow. For consider what would be the result if the seeds were not thus carried away from the mother plant on which they grew. If the seeds fell near the burdock, and a number of them grew out of the ground near together, their big leaves would overlap and destroy one another by cutting off each other's sunlight. This is the reason why the burdock and, in fact, all other plants have ways of getting their seeds scattered about or carried afar from the plants that bore them. They need more room, more light, more soil-food, more air, more moisture, than they would be able to get if they were left to sprout and grow close to the old plants. And so burs of the burdock cling to your clothing or to the dog's fur or the horse's mane and the cow's tail, doing great damage to everything they touch, but gaining their own selfish advantage through it all. Therefore these plants, like all other selfish creatures, are disliked by everybody. They are greedy in crowding out all other plants by monopolizing the soil. They are land monopolists of the most overbearing type. They ought to be rooted out of the ground by being hoed up when young. They should be burned and their big roots chopped out from the soil if they have grown large.

The dry seed (called the akene in all of this family), under a lens is oblong, flattened, and wrinkled. From the top of the seed a number of short, brown bristles stand out an deasily break off as fine chaff. These bristles are the calyx—all that is left of the outer part of the flower. Within the calyx the little corolla, a small white and purple tube that is a five-rayed star at the top, conceals the stamens, but shows the two-forked style that projects out of the tube. The style is often covered with little grains—the pollen dust. This comes from the stamens, and has been brought from other burdock flowers by the bees that go from flower to flower in search of honey. The pollen causes the seeds to grow strong and to ripen. Pupils can make doll furniture from the burs by joining the burs together to form chairs, tables, baskets, etc.; for the composite flower house is a fortress bristling with spears bent at the ends like pruning hooks, so that they lock firmly together when united. With all these advantages, it is little wonder that the burdock wins in life's struggle. To **get rid of burdock** we must prevent it from seeding, and must cut out the deep root a few inches below the surface of the ground. It should not be permitted to go to seed, for the land owner who permits their seeding inflicts damage upon many other people by his neglect to uproot and burn them. When the plant is about ten inches tall, cut each weed close to the ground and with a sharp knife make a circular hole into the heart of the stub left in the ground. With a common machine oil-can, fill this depression with kerosene. Repeat the dose the following morning. The hollow place in the stub may be filled with fine table salt instead of kerosene. Fifteen to twenty drops of crude carbolic acid will also prove death to the weed. It takes but a few minutes to apply any of these remedies.

Ants and Aphids.—Burdock is often covered with black plant lice, and these are attended by many ants that get sweets from them. For each aphid gives a sort of honey to the ants, which are very fond of sweet food. Certain ants are said to milk the aphids, to herd and care for them, in the summer, and to remove them to underground galleries for shelter during the winter. The following account has been prepared from a lecture by Dr. R. V. Chamberlin before a class in nature work at the University of Utah.

ANTS THAT KEEP COWS.

Certain ants keep cows. Perhaps many boys and girls are aware of the fact. Our own species of ant herders and milkers are among the most interesting of insect dairyists. We overlook the wonders and beauties of our own land and deceive ourselves with wonders that are reported to us from afar.

Finding the Tent Builder.—On your next summer visit to the cool recesses of any canyon you may find a tiny black ant—one a little larger than the species that is not uncommon about houses in our dry valleys. You see the ants going up and down in long lines on the trunks and branches of trees into small tents or mud sheds, which they have built on the sides of the branches. It is not wise to disturb the ants. It is better to watch them. This species, which might be called a herder or milker ant, has been called the western tentmaker; but because it was first found in Utah, the scientists have named it the Mormon; and I suppose it will give offense to no one to call it by its name. It is a diligent herdsman, an industrious worker, a tidy, cleanly housekeeper, and a valorous but prudent fighter. It has a sting and will fight passionately if you tread upon it; otherwise it minds its own business. The whole colony, if numerous, will fight any intruder who disturbs their nest; but if the colony is small, they may retire without fighting. This trait manifests a discretion so sensible that we could scarcely have believed it of ants had it come from a source less authoritative than our friend Professor Chamberlin, whose patient observation of the creatures appears to have established this curious fact.

Rear and Feed Their Cows.—Some time when you loiter near a canyon stream—not when you are in a hurry, but on some quiet and restful summer day as you recline on the warm ground in the shade of the whispering pines, just turn over a flat stone. Clustered in the excavated rooms beneath, you may see groups of small black ants (the workers); some larger ones with four gossamer wings (the kings and queens); some pretty, yellowish bodies (the nymphs, or pupae) larger than the ants themselves; some smaller, legless, white grubs (the larvae); and some minute grains (the eggs). Along with all these, you may see bunches of aphids, or plant lice. These are the "cows." The ants will become greatly excited at your intrusion; each worker will seize an aphis in her jaws, and then rush with it into the underground galleries. Soon the ants and aphids will all have disappeared. But you will have noticed that these ant-cows appear to have been very fat, as if well fed and cared for. And such is the fact. Our gardener at the State Normal often comes across the ants and their aphids on the roots of his plants and trees. These garden ants are subterranean in habit, but take the same care of their cattle. They raise them by carrying into their nests, or formicaries, the aphis eggs from the colonies upon the green stems above ground. In the ant burrows, the aphids are protected from their enemies and from the severity of the weather. They are tended through the winter months, and carried from root to root or from root to branches, in order to be supplied with food upon their appropriate feeding grounds. The ants will mine along a root till they find the tender, sprouting seeds; there they will build little caves, or mines, and put the aphids on the young and juicy tissues.

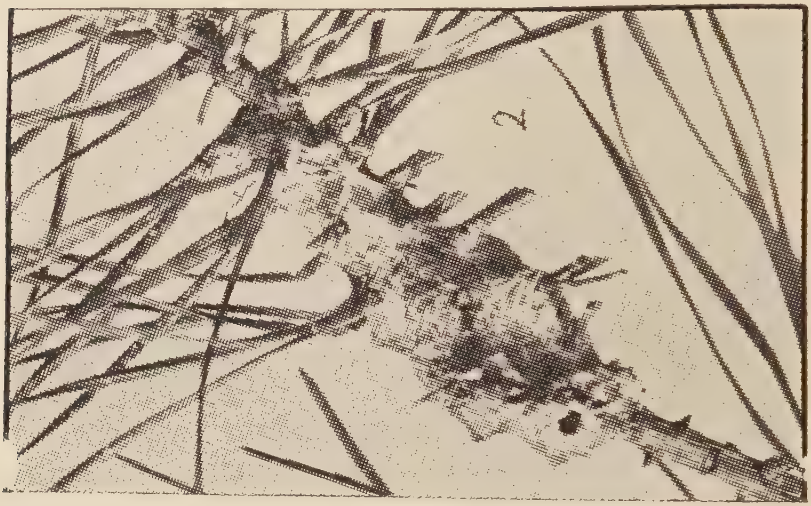
Full Name of Our Herder.—This western tentbuilder is one of our commonest ants of the first group. It has some wonderful cousins in the tropics, the Madagascar kind building a tent, or shed, over a foot in diameter, in which to keep its herd of domestic animals. Our own pavilion-maker is just as remarkable, though very much smaller. For such a tiny thing, it has a wonderful name. Cremastogaster lineolata is the name of the tent-maker found all over the United States. Our own species has certain peculiarities of its own. It is a sub-species called comitata, but being a variety of that sub-species, it has yet another name. Its last name is mormonum, given to it because it was first found in Utah. Thus our wonderful little builder and herder bears the following name: Cremastogaster lineolata comitata, var. mormonum. You may call it indifferently by any part of the name that suits your fancy; or you may abbreviate it into "the Mormon" or "the tent-builder." In scientific interest, the little creature is well worth its longest name. In the canyons, you will find it in large or small communities under stones or the bark of fallen logs or under willow leaves, but always near trees and not far from streams. It has a curious, reversible abdomen, which it contrives to bend over its back, or thorax, by reason of a flexible, two-jointed waist, or pedicel. It is frequently seen in this altitude—a posture that makes it look larger and supposed to be useful to the creature in frightening or deceiving its enemies. The next peculiarity is its almost constant occupation of tree-climbing, the workers going in long, irregular columns, single file, looking for their prey. But what do you think the prey is? Their search is not for alert wild game, but for certain sluggish creatures that they domesticate. Each huntress here is not a Diana seeking to transfix the nimble deer, but a sort of cowboy, or cowgirl, to be more exact, looking for cows. If you find them on pine trees, they are searching for minute scale insects called coccids; not to eat, but to milk. The coccids shed a honey dew; and honey is really the national dish of the whole ant race. The ants drink up this honey

AN ANT MILKING A ROSE-APHIS OF ITS HONEY-DEW.

from the very body of the scale insect, which yields it more freely in response to the caresses of the ant.

Ant's Cattle at Home.—If you see the tent-makers running up stems other than those of coniferous trees, they are seeking aphids, or plant lice, and for exactly the same purpose; they want them for cows. The aphids secrete an abundance of honey dew. You may have noticed it on a summer's day when reclining under a box elder tree—small drops of dew have rained down upon your face. If so, it is most likely this ant-honey. Every one knows the tiny greenish bugs that infest young rose bushes, house plants, garden crops, and trees. The nurseryman kills them with tobacco smoke. Their life history makes an interesting chapter. As soon as the ants find a colony of aphids or coccids, they manifest their pleasure and celebrate their success by milking them. They stroke the backs of their cows, which emit from tiny projections at the rear of their backs, the shining drops which the ants drink. Aphids and coccids have so many natural enemies and are so limited to one spot that the ants would not have them long, were it not that they take care of them. Soon after the ants find the aphis, they build sheds for them.

Tents or Pavilions.—These structures, often called tents or pavilions, are made of earth or of wood chewed into a pulp resembling blotting paper. Some of the ants' cousins, the wasps, as you know, manufacture out of wood a very thin gray paper for their nests; but this ant makes a thick paper to withstand the rain, or mixes up fine soil pulverized into a mortar for the purpose. The tent paper is called carton. The sheds for the ant cattle may be found on the branches of our pines. These sheds are an inch or two in length and half as wide, with but one opening, and this a very small one, located at the lower end to keep out the rain. From their own nest to this shed, the ants may then construct a covered way. Inside these pavilions will be found the aphids or the coccids, which, if left to themselves, would simply cling to one spot sucking the juice from the tree, and when the juice failed would soon perish. The coccids do not move at all, and the aphids are not Columbuses in this respect, though they do, from time to time, shift a little. But the ant herders carry them to fresh places on the plant—into new and greener pastures, or out into the open air for sunlight. The pavilions serve four purposes: 1. They keep the aphids within the inclosure; 2. they protect both the aphids and the coccids from their numerous enemies; 3. they protect the "cattle" from wet, and cold; 4. they protect and shelter the ants, when away from their nests.



ANT TENT.
A Shed Built of Carton Paper by the Ants for the Aphids.

Other Ant Herders.—Another of our ants has habits very similar to these of Mormonum. In its European form, Lucius niger, it is black. Americanus, the American variety, has a further subvariety here in the West, which is pale in color, being brown and undersized. Our specimens were taken by Dr. Chamberlin near the mouth of the canyon. It prefers a pale aphid, which lives underground. The ant makes its own nest under a stone, with several chambers there and a passageway leading to the roots of some plant, on which it constructs its pavilions. Some of its aphid tents are on the roots, and some on the stem of the plant chosen. It carries the aphids from root to root and out into the sunshine. The aphids, clustered on the slender rootlets, which they clasp with their feet, depress their heads, when with their beak-like proboscis they pierce the tender bark and pump into their bodies the sweet sap coursing within. As the aphis body fills with the plant sap, its abdomen is elevated, and a tiny dew drop glistens upon it. The ant immediately drinks the exuding honey dew and then strokes the body of the aphid with her antennae, and other drops are said to be given out by the aphis, as if it were pleased with this caress. Mr. McCook observed that the mound-making ants of the Alleghenies, which have vast communities centering in large conical mounds, travel far to trees that are tenanted by aphids, which they milk till their own abdomens swell and become semi-transparent with their honey burden. Returning to the nests, these "repletes" give up a ration of this food to the hungry workers there. "The process is a curious one. The replete is reared upon her hind legs, her fore legs outstretched and her head elevated. A pensioner in like attitude faces her, her jaws lifted up against her jaws. Presently a droplet of honey-dew appears upon the replete's mouth, hanging to the maxillae beneath. You may see two, or even three, ants thus feeding at once from the same replete." "The ant laps honey-dew from the aphid; the aphid pumps sap from the tree; the tree draws moisture from earth and sky, and earth and sky receive rain from the sea."

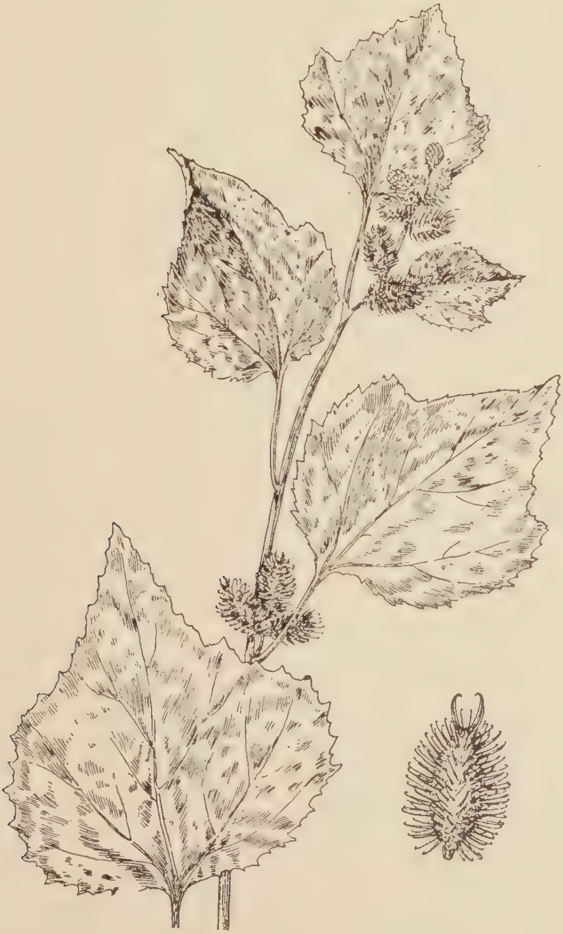
Domestic Animals of Ants.—Besides aphids and coccids, ants permit certain other animals to live in their dwellings. Common among the ants' companions are bug-like and louse-like species. Ants seem never to pay any attention to these particular insects, which have become blind by thus living underground, while other interlopers are at once killed. Lubbock thinks these obscure species may act as scavengers in the ant cities. Of certain guests, however, the ants take the greatest care. There is also a curious blind beetle (claviger), that lives with the ants and appears to have lost the power of feeding itself. At all events, it is fed by the ants, which seem very fond of their guests. Lubbock thinks these beetles may emit an odor that is agreeable to the ants, and that the latter keep them, as human beings first kept some of the domestic animals, primarily as pets. Little ants that live with larger species seem almost "to be the dogs, or perhaps the cats," of the larger ones. Andre gives a list of 587 species of insects that are habitually found in association with ants, of which 542 are beetles of various kinds.

Food of the Ant Races.—There are several other kinds that milk the aphids and build covered ways or "barns" near the ant homes as a protection to their cattle. As to other food, the emmet national dish is honey, either from flowers, fruits, plant galls, or aphids. The scale insects called coccids, most ants will devour in large numbers, rather than domesticate. Ants likewise eat almost any animal food or sweet substance, and so destroy large numbers of other insects. Scale insects are ugly little bugs that cling to the bark of trees, sucking their sap. Our worst species is the San Jose scale. They are mere flat scales that can be scraped off. The cochineal bug of Mexico is a scale insect, furnishing the red coloring for candies. The lac insect of India is another. It furnishes the shellac used to cover articles finished in lacquer work. The San Jose scale is so destructive that it might pay to try to find an ant especially fond of this scale. For similar reasons the Prussian government has issued an order forbidding the destruction of the wild ants in the forests of Prussia. Dr. Wheeler has investigated some peculiar Texas ants of the family Poneridae. Less prolific than other species, the feeding habits of their larvae are also peculiar. The workers capture another insect, cut it into pieces and scatter the pieces among the larvae, which insert their long necks through the cut surfaces, and feed upon the juices of the recently killed insect.

A PIRATE OF THE FIELDS—THE COCKLEBUR.

The Cocklebur is even uglier than the burdock. It is also much more of a field pirate. It is more vicious and destructive to the wealth and well-being of the people than is that big-leaved soil-monopolist. This weed is unfortunately so common that it may be known without much description. The leaves and stems are harsh and coarse, especially when it dries; they are rough, the stems sometimes spotted with brown blotches. In form the leaves are broad triangles, more or less heart-shaped, and with wavy or cut edges, but mostly entire. The flowers are not at all showy, and students are often puzzled to make out that it has any flowers at all. The flowers are there, however, and of two kinds. Those which bear the seeds are called the female or pistillate flowers; these form the prickly burs, with two flowers and later two seeds in each bur. The bur is the flower cup, or involucre, and corresponds to the bur of the burdock and to the flower-head of the sunflower and aster. But this vicious plant has turned the scales of its involucre into the dagger-like spines that cause us so much annoyance. It has done this, of course, to protect its seeds from being eaten by animals and to make sure that many of the burs will be carried to new fields on the fleece of animals and the clothing of people. The seed cup, or bur, is called the fertile involucre. While quite young and soft, the bur is closed; but each seed thrusts a two-forked style through an opening in the largest spine at the tip of the young bur. Two of the spines are much larger than the others and are located at the top of the bur. The openings in them, through which the styles project, are not larger than a very fine needle.

Structure.—The styles must come out of the bur in order to catch the pollen grains that fall from the other flowers, called the male or pistillate flowers, which are just above the burs on the same plants. Plants with showy flowers get their pollen carried from one flower to another by the moths, bees, butterflies, and other frail children of the air that go to the flowers seeking honey. But plants like the cocklebur, devoid of beauty and sweetness, must depend upon the wind or upon their own devices for the fertilization of their seeds. The cocklebur has therefore placed its stamens in flowers by themselves, just above the flowers that bear the seeds (the burs), in



COCKLEBUR.

flower cups (involucres) that are only small, shreddy rags, and without any beautiful corolla, or even a calyx. For the involucre is not a calyx, as some have supposed, but an outer covering that shields a number of flowers, and each of these flowers within the involucre may or may not have a calyx of its own. And so the flowers of the cocklebur, bereft of the usual covers, are said to be naked.

Has No Friends.—Insects of good taste rarely visit the cocklebur. There is no sweetness or beauty in its whole make-up. Coarse, ugly, and rank-scented, the very insects avoid and seem to despise it. No butterfly, moth, or bee delights to hover about this weed, nor do the grazing animals browse upon it. The only portion of the cocklebur that might be eaten is the seed, and this part is securely locked up in the strong bur. Thus, asking no favors and giving none, the cocklebur selfishly lives unto itself. It exists for itself only, and has therefore become both disagreeable and dangerous. It annoys, scratches, wounds, all that have anything to do with it. The burs cling to the fur of dogs, and the dogs injure their mouths in trying to bite out the burs. The burs get into the manes and tails of the horses, and cause these animals and their owners much annoyance in getting rid of them. Worse still, they catch in the tails of cows and form matted masses, so that the cows are tortured by the burs whenever the long tail is lashed from side to side in driving away the flies. Those who milk the cows are likewise tortured by being struck by the bur-laden tail. The burs cling to woollen clothing, and wound our fingers as we pull them out. But worst of all, probably, is the loss inflicted on sheep owners when the burs get into the fleeces as the flock passes through a patch of these weeds that have gone to seed. Much wool is spoiled in this way, and the yearly loss to the flockmasters from the cocklebur pests must be considerable. It is therefore the duty of all people to destroy this obnoxious plant. The pupils of the schools can render most effective aid in this good work by gathering into piles and burning all the cockleburs that are to be found on or about their premises. It is against the law to permit this weed to grow on land owned by anyone. The continued presence of this weed is therefore both disgraceful and illegal, as well as expensive to agriculture and annoying to all people.

LITTLE BEASTS OF PREY.

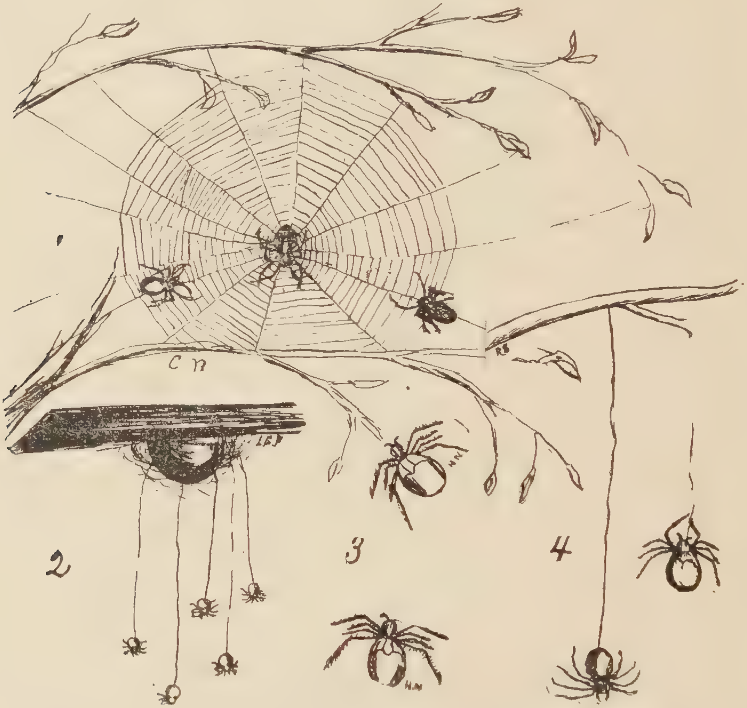
Spiders are chief among little beasts of prey. They feed on the insects. They are not insects themselves, but are like lions and tigers to the insect world. The hunting spiders run on the ground or on plants, and catch their prey by springing upon it as the larger carnivora do. The cobweb spiders make nests for catching insects, and live in the web or in a nest nearby. There are vast numbers and many families of each great class. Their habits are fascinating, their actions intelligent, their resourcefulness wonderful. They present an easy field for observation, leading to the discovery of the marvelous ways of these "little folk." Our fifth graders did some work on this interesting group one year in October, and we give a summary of it here for the benefit of fellow students.

Work in the school room.—It is still possible in October to collect the eggs of spiders, though the best time to begin observing these curious creatures is in September. The eggs are laid in little bags of hanging spider web, or in cracks, under boards, scales of bark, or stones. The eggs should be kept in a cold place for hatching in spring.

The fifth grade pupils at the training school captured a number of spiders early in October. These were put into chalk boxes with glass or wire fronts, containing some earth, twigs and leaves, and were fed upon flies. After several weeks of almost daily observation of their ways by the children, they were requested to tell in writing what they had seen and learned.

Watching the Spider.—"I watched a very large gray spider, with long legs and a large head," wrote one pupil. "It had its home in the weeds and was clinging to a tall weed. It had eight legs, and I noticed that there were little hairs all over them. Spiders build their webs in the fall. They have to eat most of the time, because what they eat goes to make the thread out of which they weave their webs. One web does not last the spider all the time, because when an insect gets caught in the web, it breaks it, and perhaps the spider running about would break it, too. The spiders have a head and an abdomen. This is different from the insects, because the insects have three parts to their bodies."

"All spiders have eight legs fastened to their head part." wrote another. "They have eight eyes, too. [One small family have only six eyes.] We have ten spiders in our room, two with little, tiny heads and great big bodies. One has spun a kind of cocoon in the top of the box. We think the cocoon is full of eggs, but we don't know for sure. We put leaves and grasshoppers in their boxes, but now they are acting as if they are dead. On Saturday I came up to the school garden to get some tomatoes, and as I was going home I saw a gray spider. I tried to get it, but it went down into a hole.



1. Black garden spider choosing a mate. Two males are seen on the outside of the web cautiously approaching. 2. Little gray baby spiders descending from the mother's nest . 3. Large orb weavers, when ready to spin. 4. Adult spider swinging from limb; another returning.—Drawn from nature by fifth grade pupils of the Training School.

"The female spider eats the male spider. It will spin a web, then go up in the middle of the web. The male spiders will come slowly up the web, so as to see whether the female wants to choose that one for her mate. If she doesn't want him, she will kill and eat him. But if she does want him for her mate, she will let him stay in her house, but at last she will kill him too."

Ways of Spiders.—A third wrote this: "After the mother spider tires of her mate, she turns round and eats him up. When her dress falls off, she eats that, too. She lays her eggs in the fall. Her cocoon looks like a ball of pink silk, with a white ball inside. Sometimes she goes to sleep by it. At other times she just goes to sleep anywhere. Some spiders will get a beetle and lay eggs all over him, and when the baby spiders get hungry they take a bite off the beetle. Then others get the baby spiders on their own back until they are large enough to take care of themselves. The tarantula never eats her mate. They live in peace together, for when you find one you are sure to find the other in a short time looking for the one you saw first."

Catching Garden Spiders.—A fourth gave this account: "One night when I was going home there was a great, big gray spider. We tried to catch it, but it ran in the grass. I tried to get it on a stick, but it ran down into a hole. Then I saw a little black one, and it went down into the hole, too. There is one little spider that I brought in, and some one has put a fly in its box. It has started to spin a little. The big yellow spider spun a web, and it has caught some flies. It now acts as if it is dead. The spider that has some flies started to eat them. He eats the head first, and just leaves a little bit. The spiders that we have are called the garden spiders."

Spiders in Captivity.—A fifth one wrote as follows: "In our school room we have eight or nine spiders. We have two that look as if they had a face on their backs. They act as if they are dead. One night one of them spun a web. Now both of them have webs and cocoons. Some of the spiders in our room are in boxes and some in bottles. They like to get up to the top of the box or bottle, so they can get the air. We have a red and a black and two brown spiders, also other colors. One morning we got a great big spider, but it was dead. The teacher told us the spiders would eat grasshoppers and insects. The spider builds more than one web a year, because its web gets broken. When it spins a web it makes a place on the outside for itself. When it is home, it stays in the place it has made for itself, holding a string from the web. Then if an insect gets in the web the spider can feel it. The spider can tell its size, because a big bug shakes the web more than a little one. If is a big bug he lets it stay there until it gets tangled up, and then he comes up and gets it. If it is a little insect he will run out and get it. When we first caught our spider it made out that it was dead. We put it in a box, and the next day it had spun a cocoon. The web is made of pink silk. We think that inside of the web are some little spiders. The two spiders are yellow and gray. Their home is in people's houses, in trees, corners, chicken coops, coal houses and in any hole or corner they can get. The spiders spin webs so that they can catch flies. They can tell when there is something in the web, because they have one leg on one of the threads, and when anything gets in it pulls, and the spiders run up and kill it."

The Mother Spider.—A sixth added this: "The mother spider spins her web and lays her eggs in a snug little place to keep them warm. She puts her eggs under a roof or in a box or between old logs or boards or anywhere that they will keep warm. She puts them where the rain and ice and snow can't reach them. When they hatch they are so tiny one can hardly see them. They generally hatch in the spring. The baby spiders are very tiny when they are hatched. They go stringing down on little threads. Then they take care of themselves. They hang on these threads till the wind blows them on a bush or fence or tree or any good place, and there they spin cocoons. There are about 800 spiders hatch out of the eggs from one spider. They are hungry when they come out of the eggs. At first the mother spider catches flies for them. They grow very fast and become big in a little while.

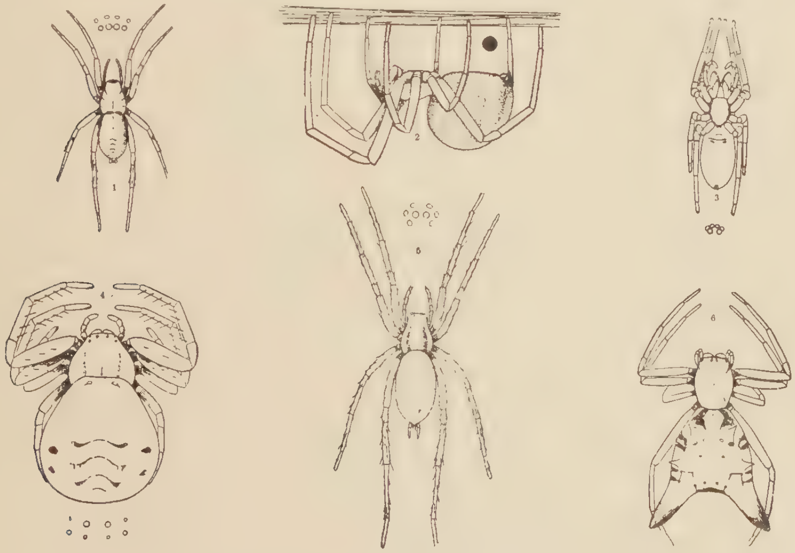
"Sometimes the spider carries the eggs on its back. The little spiders stay on their mother's back until they are big enough to spin a web for themselves. When they are big enough they swing down on a little thread, and all the babies get in a mass so that you can see nothing but legs and threads. From there they let a little thread blow out in the wind, and wherever they swing from that they weave their webs."

KINDS OF SPIDERS.

Number of Species.—Spiders are among the most interesting of small creatures. They are also the most familiar. There are so many kinds of them that 300 or 400 species may be found near any city. Some kinds are so small as to be seen with difficulty. Others, like our tarantula, are so freocious in appearance as to excite terror and give rise to dreadful tales. Few spiders bear common names. The common house spider (Theridium) spins light webs in the corners of rooms. The cellar spider (Pholcus) weaves thin webs about the stairs and shelves.

Jumping Spiders.—A common, gray spider (Epiblemum) that lives outside of houses, on fences, etc., is a member of the class called jumping spiders. This one is quick in movement, short and stout, one-fourth of an inch long, marked with white. The eight eyes in this group are hard to find, because they are placed so far back and are so small, that the creature appears to have only two. Large jumping spiders make nests of white silk under stones near the ground. They are called Phidippus, are mostly gray or black, and are half an inch long. All these spiders walk sideways as well as forward, and jump to great distances. They make no webs, but may spin silken bags under stones in which to pass the winter or to lay their eggs. Another jumping species common on fences and houses is Marptusa, half an inch long, and gray, with long, white hairs. but marked with dark bands. These run about for their prey on plants. Some of them weave silk nests among the leaves.

Web Weavers.—A group called the round web weavers live about houses. Three brown kinds (Epeira) hide in cracks, and at night make their round webs in porches. They live in these circular



1.—Drassus, one of the ground spiders, note the eight eyes arranged in two rows. 2.—Theridion, a house spider and web weaver. 3.—Dysdera, one of a group with only six eyes; a Cuban relative has but two. 4.—Thomissus, one of the crab spiders, so called because some of them, like crabs, walk sidewise best. 5.—Agalena, one of the grass web-weavers, which builds a tube retreat from its web. 6.—Eperia spinea, a circular web-weaver, with spiny body; the two first pairs of legs are longer than the others and the eyes are widely separated.

nets with back or head downwards. The legs are long and often spiny. Some have humps or spines on the abdomen, which is often marked with a bright triangular pattern. Their webs consist of two spirals—an inner, that begins in the center and winds outward; and an outer spiral that begins at the edge of the web and winds inward. The inner spiral is so smooth that dust will not stick to it; the outer is elastic and covered with fine drops of a sticky liquid to catch insects.

On the outside of houses are to be found, also, numerous web-weavers (Dictynidae) that have, besides the six spinnerets common to other spiders, a flat, wide spinning organ called the cribellum in front of the others, and covered with finer spinning tubes, besides a row of hairs (the calamistrum) on the hind legs. This is used to draw out a loose band of silk from the spinnerets. They spread their webs wherever there is room for them.

Ground Spiders.—A group called the ground spiders (Drassidae) live on the ground or in bushes, with nests in the form of a bag or flattened tube. These spiders are about three times as long as they are wide, with legs of about equal length; they are of a velvety appearance; the feet have two claws with a brush of flattened hairs under them. The colors are dull gray, brown or black.

Another group living on the ground are the Licosa genera, which include our largest spiders allied to the European tarantula, described in another place.

Flower Species.—Among the flowers, in which they live, are the Misumenas, one of which is sometimes half an inch long, its legs spreading an inch and a half. It is white or with two crimson spots on the abdomen and one between the eyes, and the sides of the thorax darkened a little with yellow or brown. It has also white portions in its face, and is a showy as well as a common kind. The males mature early, remain small, and are variously colored with spots and bands. The females grow to several times the size of the males. The female is always considerably larger than the male spider, but here the disparity is exceptional. The Misumenas stand among flowers and wait for their insect prey.

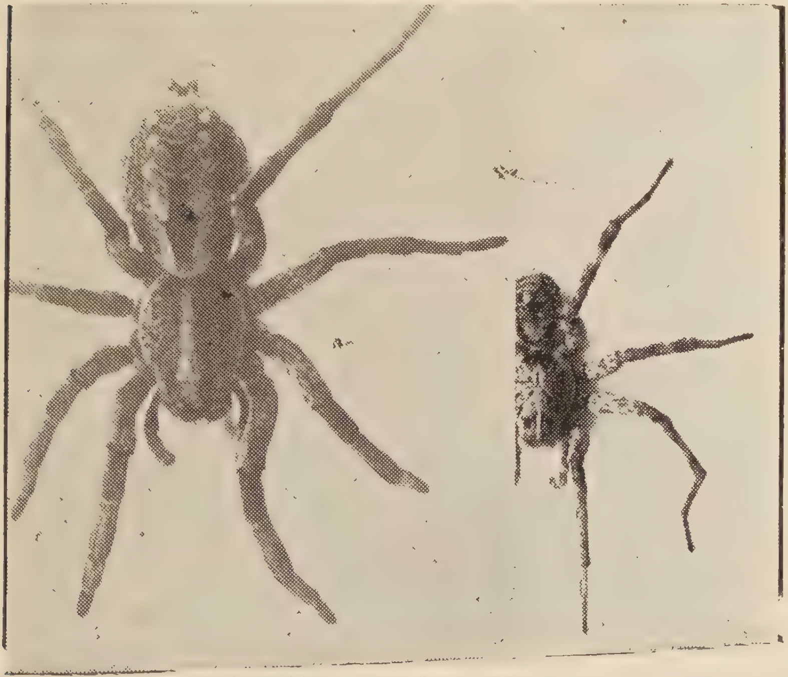
Parts of the Spider.—The body is divided into two parts, connected by a thin joint behind the last pair of legs. The front part is called the cephalothorax. It contains the stomach, the central part of the nervous system, and the large muscles that work the legs and jaws. The hinder half is the abdomen. It contains the intestine, the breathing organs, the principal vessels, the organs of reproduction, and the spinning organs. There are four pairs of legs, a pair of palpi resembling legs, and a pair of mandibles. The legs are seven-jointed, the last point containing various hairs, spines, and three claws. One claw is often replaced by a brush of hairs, enabling the animal to walk up steep surfaces and to keep its face and mouth parts very clean. The palpi, in front of the legs, are six-jointed and are used as feelers and for carrying food. The mandibles, or first pair of jaws, are two-jointed, the joint next to the body often furnished with teeth and hairs, while the outer one is a claw. Behind the last pair of legs, on the under side of the abdomen, are two hard, smooth patches, which cover the front pair of breathing organs—two little slits. At the end of the body are the silk-making organs, or spinerets, in three pairs. The third pair of spinnerets, often extend behind the body like a pair of tails. There is also a breathing pore (spiracle) leading to air tubes that branch through the abdomen. The front of the head has eight eyes, variously arranged in different species. The mouth has an upper and an under lip.

Courtship of Spiders.—The male is usually smaller, but has legs relatively longer than the female. He is also darker. These differences become so great in some species that the males and females would be taken at first to belong to different families. Van Hasselt found that in some cases the same dimensions applied to the human species, would result in a man six feet in height and weighing 150 pounds married to a woman seventy-five to ninety feet in height and weighing 200,000 pounds. Concerning one of the jumping spiders, a gray Attida about the size of a thumb nail, we have learned from Dr. Howard, curator of the museum of the University of Utah, something of its courtship. In the month of July an interesting scene among spiders occurs on the borders of the Great Salt Lake, and it has been closely observed by him. At that season, these spiders come down to the shores to feed on the insects that abound there. It is at about this time also that the mating season occurs The female spider is large and strong; the male, a small, weak, but vain and showy fellow, who seeks to attract her favorable notice. Our Rosalind, however, at first pays but little attention to the insignificant Orlando, who chases about after her, taking care always to keep well out of her reach until she condescends to receive him. If the female makes a hostile movement, the male scurries out of the way. If she seems to tolerate his presence, he begins to dance before her. He displays his bright colors by standing somewhat upright, lifting his front legs and advertising his attractions until he secures her temporary friendship.

A TRAGEDY OF THE TARANTULA.

The great, hairy lion spider of the West is more successful and mighty in his own hunting ground than Esau himself, the renowned and hairy hunter of old, in the land of the East. And the hairy hunter of insects in Western America has forced himself upon the attention of the people who occupy his native plains. If Esau slew his hundreds of wild game, this hunter certainly has slain his thousands. Less civilized, according to spider standards, than Esau would have been, judged by our ideas, and far more hairy, the prowess of this indomitable hunter deserves more than passing mention. Strange stories have been handed down concerning the deadly nature of the poison of this creature, and of the human lives which its bites have cost; but authentic information on the subject seems hard to get. Let us begin, after the manner of fashionable novels, with our hero's relatives.

His Wolfish Cousins.—The group called wolf-spiders, or hunting spiders, capture their prey without entangling the victim in a net or web. Similar in certain habits to these beasts of prey is one that we may call the lion spider (Eurypelma hentzii.) It is commonly, but erroneously, called the Western tarantula. On account of its size and ferocity, it is called the king of our Arachnida. The spider after which our hairy species has been mis-named tarantula, belongs to the genus Lycosa. The American representative nearest to the European tarantula is a spider called Lycosa carolinensis. The female of this latter species is sometimes over an inch in length, with the fourth legs an inch and a half long, so that they spread over three inches. The color is brown, like the fur of a mouse. On the under side the whole body is black. The legs are light gray with dark bands at the joints. We have this large Lycosa in the West. Members of the family lycosidae are often seen, a common black spider being one of them. Most of them live near the ground. They move actively and do not build retreats in which to conceal themselves. The females of this group carry their eggs in silky balls called cocoons attached to their bodies. When the young come out, they are carried about for a time on the back of the mother. Many of these spiders are large and stout, sometimes very hairy. The female of a sand species lives in sandy regions in burrows ten or twelve inches deep, while the male lives above ground. Their feet spread two inches, their colors much like the sand, but the marks on the back and legs make the males plainly visible as they wander about in summer. The house of the female is lined with silk, which holds the sand together. The females keep near these holes and drop into them when disturbed. When all is quiet, they come out, sometimes with a sort of jump. Pupils at the training school captured two of the notable species Lycosa carolinensis this fall, and the writer captured one. They were kept in boxes with glass fronts, containing a soil floor, and were fed upon insects. These are first among the wolf spiders—those that capture their prey by the chase.

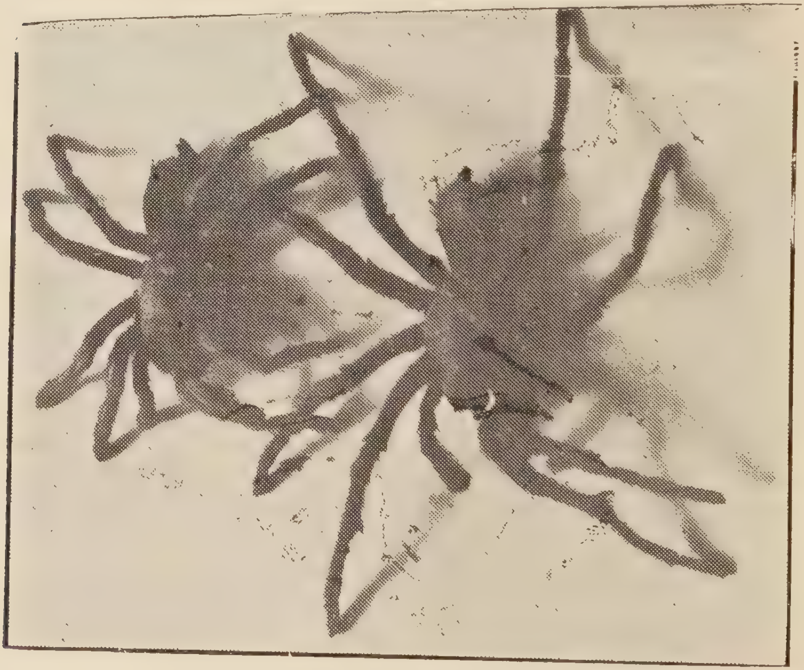


The American Wolf Spider, most closely allie dto the European tarantula. Our species is found as far west as the Great Basin where it is quite common. The female is the larger specimen. Photograph of living specimens by Prof. R. V. Chamberlin. Cut nearly life size.

The Hairy Lion Spider is of another genus, Eurypelma. He is not of the tarantula kind, being lower in the scale of organism. He lives by his wits, and overcomes by his strength and ferocity. But to our story.

The great lion spider dozed at the door of his underground mansion. It was on a sunny day in late spring. The sand bank was warm and the ferocious creature was lazy. The silk-lined passage way in the soil is the night couch and lair of the spider, but it was left open this day for the warm outdoor air to come in. He had eaten plenty of food and was taking a brief nap before setting forth on another expedition of plunder. He went out, seeking whatever he might devour. His prowess had made him careless. He had found no equal—no "foeman worthy of his steel" in all his depredations.

Every creature of the ground in the vast underworld in which he lived fled in terror at his approach. He hunted without much choice as to his prey. Flies, bees, the larave of beetles, bugs and other insects of many kinds—all the denizens of these lower regions,

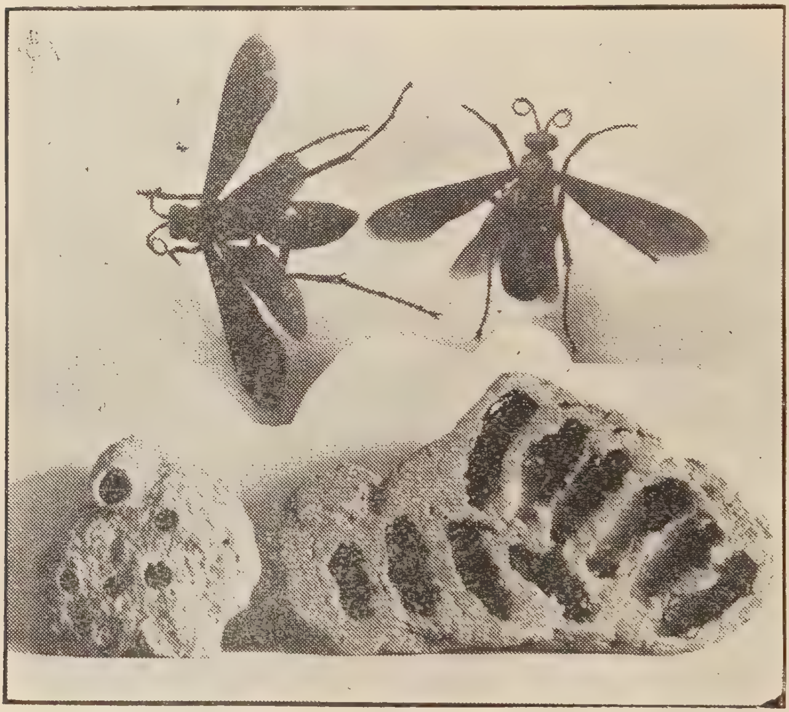


THE LION SPIDER, EURYPELMA HENTZII, commonly called the American tarantula. From photographs of specimens in the zoological collections of the University of Utah, made for this article by Mr. Tipton. The specimens with the longer and darker legs is an adult male; the other a young female. The adult female would be larger than the male.

in fact, were his victims. Some even say that he engages a mouse in battle. Every sort of animal food seems to suit him. Not that he deigned to work at making a net—labor of that sort was too low, or too high, for him. His claws were his only net, and right well they served his purpose. With eight legs he could outrun most of his victims, and with his first pair he could hold them while his powerful jaws, charged with poison, quickly completed their destruction after capture.

The Sage Brush Dweller.—Not far away from the resting place of this lordly and lazy King Herod of the spiderworld, dwelt one of the commoner families of his race—a mechanic, an artisan and artist combined,—one of the gray, sage spiders, much less than half his size. The lady spider in charge of this arachnid household in the sagebrush was one of the family known as the orb weavers and had both a web and a nest. She was a worker, and hence beyond the friendly acquaintance of the lion spider, who lived by plunder rather than by labor, and who depended wholly upon his strength and cunning. For, he had no genius for building webs and snares. Why should he, the lazy possessor of such legs and poison fangs, trouble himself to build snares? Was he not already monarch of all that his eight eyes could survey? Perhaps he watched with scorn the actions of the dainty gray lady above him. There she lay in a beautiful silken nest not unlike the nest of a ground bird. She was not idle, however; she was watching her web. This web was spun in another sagebrush, and was composed of radiating spokes and encircling lines. From her cosy nest in the next bush, she had a silken cable connecting her nest couch with the web snare. As soon as in insect got into her "parlor" and stuck to the adhesive threads, the gray spider would feel the jerking of the insect in its struggles. The telegraphic line, one end of which she held with her front claw, gave an instant message. Out she would rush and either kill and eat the insect at the moment, or would tie his feet and hang him up alive, so that he would be in good condition when it might suit her pleasure to eat him. But here comes a large, red-winged wasp, and strikes the web, producing great commotion. Out dashes the lady spider, but perceiving that the size and strength of this insect really place it outside of her sphere of "pratical politics," she cuts it loose with all speed by severing the silken cables that bind the legs and impede the wings of the enmeshed wasp.

The Tarantula Hawk.—This giant wasp is Pepsis formosa—the tarantula hawk of the West. It is a relative of the commoner and better known Western spider-wasps. Like them, it has a series of mud cells, or burrows. Some of the others use fresh mud to build the burrows, sometimes several inches in length. In each one the wasp lays an egg. Like the others, this one makes a practice of carrying a spider to the burrow. There it walls the spider in along with the egg. The spider's body will form the food of the future larva, a worm-like creature that will develop from the egg. The spread of the orange red wings of these giant wasps may reach more than two and a half inches; the body is two-thirds as long. Though its four red wings flame like fire its body is a shining blue-black. Its six long legs have a five-jointed tarsus, and are covered with a perfect saw-toothed comb of stiff hairs and bristles, all pointing toward the extremity of the leg, which is terminated by two claws. This large, predatory wasp pays but little attention to the gray spider



The Tarantula Hawk, Pepsis formosa, about two-thirds life size. Also burrows of the spider wasps, in which the living spider is imprisoned. Photographs made for this article from specimens in the zoological collections of the University.

that hastily releases her from the web that was intended for smaller and less dangerous prey. Off flies the red-winged creature, without even stopping to take revenge upon the gray spider whose web temporarily enmeshed her and delayed her flight. She, too, is seeking other game, and she wastes no time on the smaller fry. Away she goes, her finely veined and translucent wings buzzing more angrily because of this mishap. Her blood is up, and woe unto the enemy whom she now encounters.

The Proud Old King.—When we left the old lion spider, he was just awakening. Washing his face with his front legs and combing out his abundant mane and beard, he begins to look for something to devour. Shall he chase down a bug or stalk a bee or a fly? None is near, but the old lion does not stir from near his silk-lined burrow. He is lazy. Sated with the blood of many hapless victims, he, within his realm of creeping and crawling subordinates, is like crafty King Herod of old. Like him, he probably would, if he could conceive such an idea, demand their homage and adulation. His prowess and pride would cause him to be regarded as a veritable god of the underworld. At any rate, feared as soon as seen, the lion spider must have felt some sort of self-greatness in view of his remarkable preeminence over the unnumbered insect hordes from whose ranks he feasted daily. And now the proud and indolent savage carefully looks around with unabated egotism for new victims, never giving a thought to their sufferings and never doubting as to his own supremacy amid all the insect and spider world about him. For even here it seems that pride goeth before a fall.

The Hawk and the Lion.—But see! a large red-winged wasp approaches with rapid flight, coming directly towards the tarantula, who bristles with expectation and already works his jaws in anticipation of a real banquet. The tarantula hawk, however, steers straight towards the hairy beast. Striking the spider at full speed she sends the tarantula rolling in the dust and endeavors to seize the arachnid with her long clawed feet. We fancy that we can almost hear the old lion roar in his rage at this unexpected assault, as, scrambling to his feet, he rushes at his insect foe. The wary and intelligent wasp, however, rises on wing just above her savage antagonist's head, and, avoiding his fierce onslaught, again flies down at him, sending the spider rolling over a second time. Now the wasp follows up her advantage. With incredible celerity she seizes the long legs of the spider and rolls him completely over on his back —a position in which it is easy to hold him. The spider works his long legs in vigorous fury, and repeatedly tries to bring his antagonist within reach of the powerful poison fangs that have been the speedy death of so many insect victims. All in vain, however, for he cannot fasten his claws in the bristling, horny legs of the wasp, since the bristles all slant toward the spider and he can get no sufficient hold. Carefully selecting the right place in the exposed thorax of the struggling spider, out shoots the long sword-like ovipositor of the wasp, a single thrust piercing the great nerve cord, which, in the spider, as in insects, runs along the ventral or under surface of the body, right in front of and below the alimentary canal. One sword thrust of that weapon and the battle is over. The poison does its work quickly. A tremor runs through the crab-like body of the lion spider, and then he becomes motionless. But he is not dead—he is paralyzed. His eyes still gleam with a wicked brilliancy. His body will not putrefy. But he cannot move. The wasp knew just where to strike him, and now his career is ended.

Alive in the Tomb.—The second part of the drama is now to be enacted. The businesslike wasp does not pause for an instant to meditate over her fallen foe. She takes his hairy and motionless body in her "arms"—that is, she gathers the spider in her legs and mounts on her gossamer but powerful wings into the higher atmosphere. Over the tops of sage brush and oak brush, over stream and knoll, she skims with her victim, till she reaches her mud nest—a hole or series of holes carefully built in an earth bank. Into one of these openings the wasp draws the limp body of the spider, compressing the legs together in order to crowd the prey into the narrow cylindrical burrow. Having tucked the spider's unresisting body into just the right place, the wasp, fully satisfied with her work, at once lays an egg beside the spider's body and then closes the opening. In time the egg hatches into a worm-like larva, which proceeds to devour piecemeal the body of the paralyzed tarantula. For the spider never recovers from the comatose state into which the sting of the wasp has put him. The advantage to the larva of having a living instead of a dead spider upon which to feed is that a dead spider would decay, whereas the living carcass is in every way superior for its purpose as a mere article of food. Whether or not the lion spider, like Herod of old, knows that he is being consumed alive we cannot tell. Being paralyzed, the spider can give no sign to indicate that he is conscious of the last act of the tragedy in which he meets his fate.

b. Other Western Plants.

STRANGE LOOKING FRIENDS—PRICKLY PEARS.

Out on the desert, where few large plants grow, there is one kind that contrives to make a living, where other plants would starve. This is the prickly pear, or cactus, of which there are many kinds in southwestern America. Cacti have turned their leaves into spines. The jointed stems resemble thick leaves placed end on end, but they are true stems, not leaves. Cacti turn their leaves into spines to prevent loss of water. For the leaves permit water to evaporate through them, and spines do not; while spines keep large animals from eating the plants. Whoever has seen has become interested in prickly pears. They are the most highly specialized of the desert plants of the arid regions of America. They are favorites with gardeners for decorative purposes, because of their bizarre appear-

CACTI IN NEW MEXICO.

ance, their large and brilliant flowers. The ease with which they may be transported and propagated, and the charm they give to rockeries, have caused an industry to be established in Europe for their production. A species that grows as far north as southern Utah is considered one of the best for ornamental purposes; it has reddish joints, numerous spicules (but no spines), and large, rose-purple or almost crimson flowers. It is a free bloomer and perfectly hardy. Adapted, as these plants are, to the variable temperatures, the intense light, and the long periods of drought of the semi-arid regions, they do well all over the Plateau under cultivation. If given water they respond by vigorous growth and profuse flowering. When the water fails, they do not die, as other plants do, but simply suspend active operations and draw on the moisture stored in their thick stems for enough to maintain them, without further growth, till more moisture may be had. It is possible to transplant cacti of any age, at almost any time, if they are not bruised, if the roots are carefully preserved, and if water is immediately supplied. Very few of the cacti have leaves. The large flattish or cylindrical kinds belong to the genus Opuntia; these are a group easily cultivated. These have become well known in this country ever since the wide advertising of spineless or thornless cacti cultivated in southern California. These flattish stems are not leaves, but joints of a peculiar stem. These plants breathe and also transpire moisture through their stems, which approach the cylindrical shape in order, by lessening the stem surface, to diminish the loss of water. The skin, or outer layer, is much thickened and hardened for the same purpose. The large stems serve as reservoirs, while long and slender, wide-spreading roots penetrate deeply in search of soil moisture. Cacti therefore absorb moisture quickly when any is within reach, and part with it very slowly during years of drought. If the leaves were not reduced to spines, they would transpire and waste the precious fluid.

Spineless cacti, thus far, have succeeded only far southward. They are not adapted to withstand the winters that prevail over nine-tenths of the Plateau region.

Start the castor beans indoors in March or early April, or in a hot-bed; transplant into small pots or boxes, as soon as the first true leaves have formed. Set out after danger from frost is past. Castor beans give a rich, luxuriant, tropical aspect to the garden, and have no equal for a background. They will support the sweet peas, which will climb over them. Plant sweet peas early in March in a soil deeply tilled and well supplied with plant food. Open a trench about a foot wide and 10 inches deep in rich garden loam, in the bottom of which about 3 inches of well-rotted manure are placed, with 2 inches of fine top soil scattered immediately over it. Upon this bed sow the peas in double rows 8 inches apart, the seeds being placed from half an inch to an inch apart in the row. Cover the seed about 3 inches deep; after the young plants appear and have attained sufficient height, fill the trench completely with good soil.

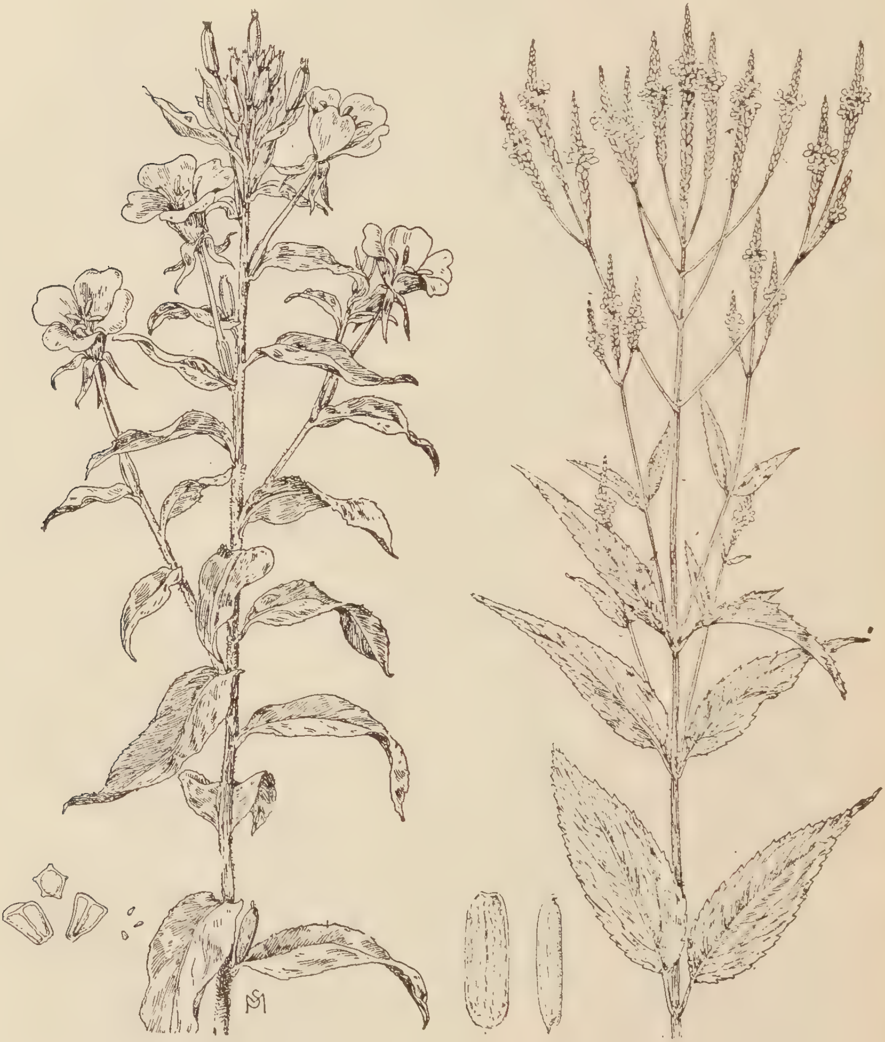
–Castor bean.

–Sweet pea.

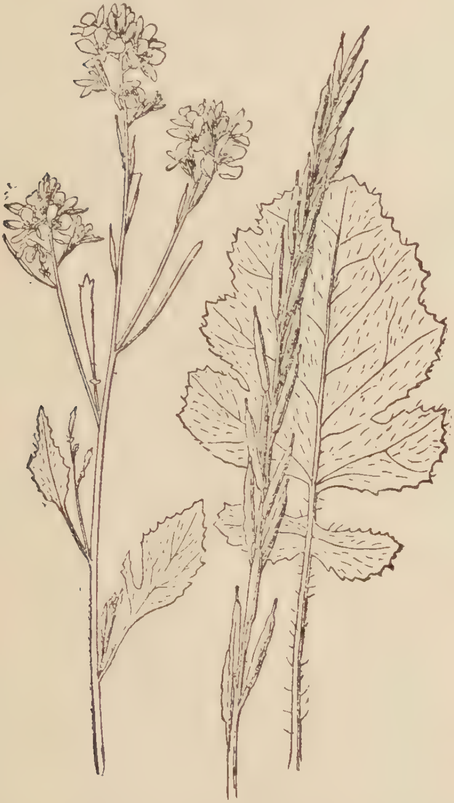
Columbine.

Scarlet sage.

Garden columbine is planted in open ground in fall or spring, and thinned to a foot apart. Scarlet sage makes a beautiful border of intense color late in autumn; it is started in window boxes.



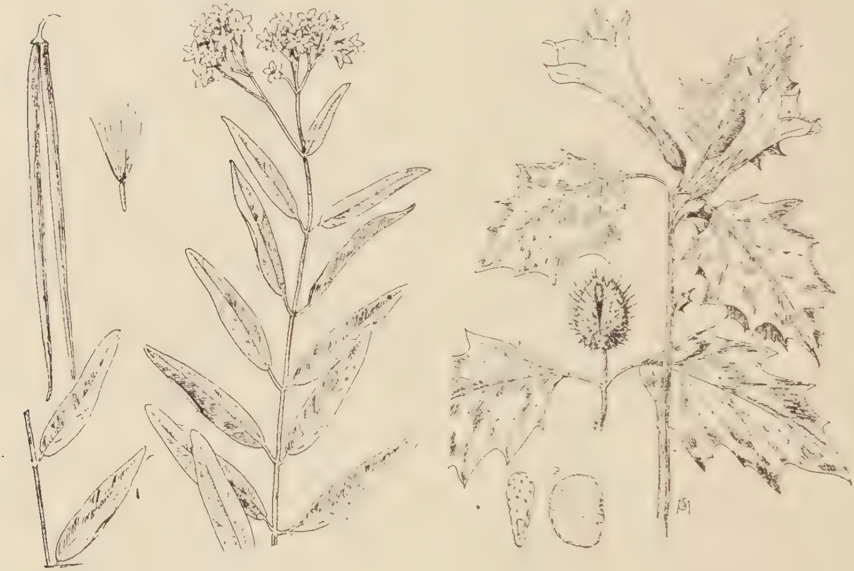
Tall evening primrose at left; the yellow corolla opens at dusk. There are half a dozen kinds. All have 4 petals, yellow to white, 4 reflexed sepals, long 4-celled pods, 8 stamens, leaves alternate or basal. Blue verbena at right, 2 to 7 feet high; leaves opposite, taper-pointed; violet blue, small flowers in narrow spikes, a few open at a time, in summer and early fall. Both prefer moist, low grounds. The mat verbena (V. bracteosa) forms a woolly rug of long, leafy stems on dry ground, its small blue flowers hidden. Verbena fruits split into four nutlets.



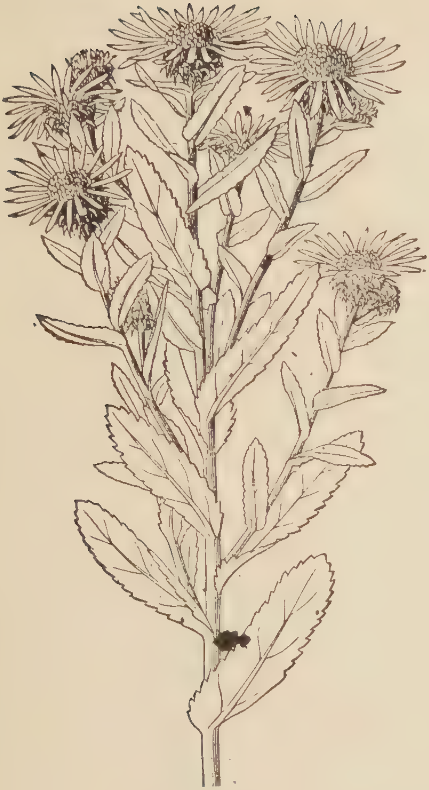
-Black mustard (*Brassica nigra*

Black mustard may grow 4 to 6 feet high, bristly hairy below, smooth above; leaves dark green, rough with bristly hairs, the lower ones lobed, the top lobe largest. Bright yellow flowers small, scarcely ¼ of an inch in diameter, the four petals spreading, each consisting of a rounded blade with a narrow claw. The petals alternate with the pale-green sepals, or calyx lobes. The flowers appear in clusters at the ends of the stems, followed from July to November by the numerous erect pods crowded against the stem in dense narrow clusters. The pods are about 1 inch in length, 4-sided, smooth, and tipped at the apex by the short, persistent style. The seeds contained in the pods are very small and numerous, globular, blackish-brown, and finely pitted. The plant is an annual, and if care is taken to prevent the distribution of the seeds it is not difficult to exterminate. The seeds possess great vitality, and may remain in the ground for years before germinating. Seeds can be collected and made into mustard.

White mustard is similar, but the pods spread widely, the flowers paler yellow, the leaves more deeply divided. The seeds are sold at from 3 to 6 cents per pound. They are used in medicine, for making hot plasters, in dyspepsia, and as an emetic. Our commonest kind is the hedge mustard. One has leaves very much cut, and awl-shaped pods close pressed to the stem; the other has the pods diverging almost at right angles to the stem. These would be taken for the black and the white mustard, which are more rare and which have a distinct beak at the end of the fruit.



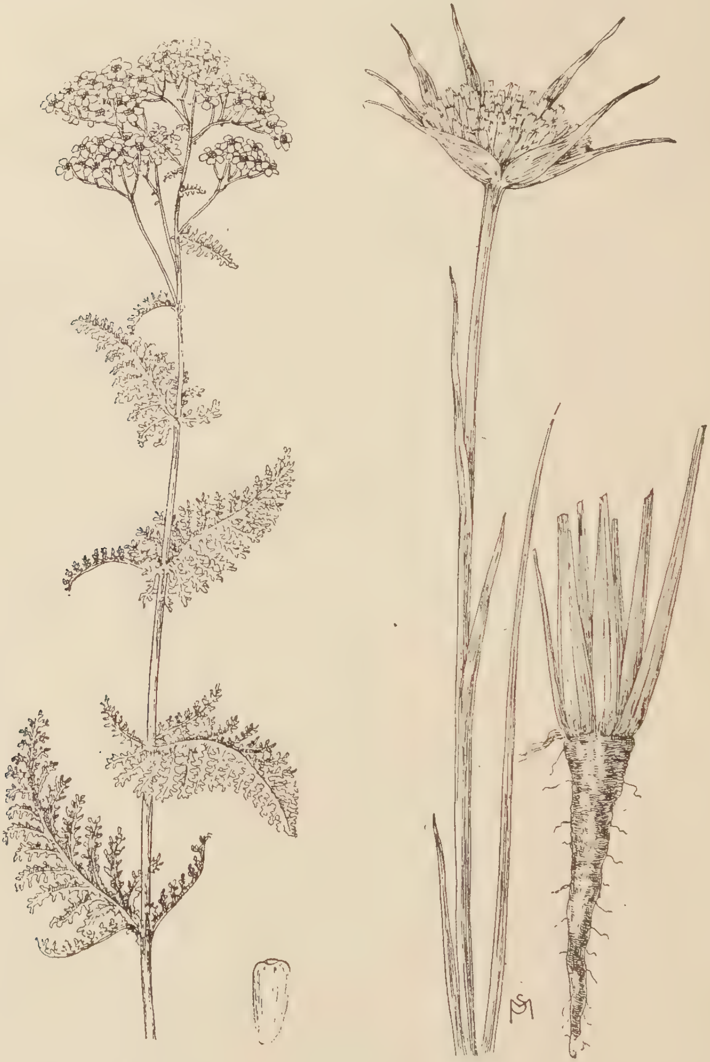
Dogbane, at the left, with a pair of long pods, silky seeds, opposite leaves and flat-topped clusters of white flowers, has a milky juice, but is not one of the true milkweeds. Jimson weed, at the right, is a coarse, narcotic, poisonous plant, with large white flowers, in the form of funnels, and ovoid, prickly burs. It belongs to the potato or nightshade family, Solanaceæ, which includes many herbs or shrubs, with foliage rank scented, and fruit ranging from very poisonous to edible berries. It is a prominent family in the tropics, about 1,600 of them being known. Here are found the potato, tomato, tobacco, petunia, jimson weed, henbane, matrimony vine, bittersweet, horse nettle, buffalo bur, apple-of-Peru, and common ground cherry, which should be studied in comparison with any of these plants that can be found.



—Scaly grindelia (*Grindelia squarrosa*

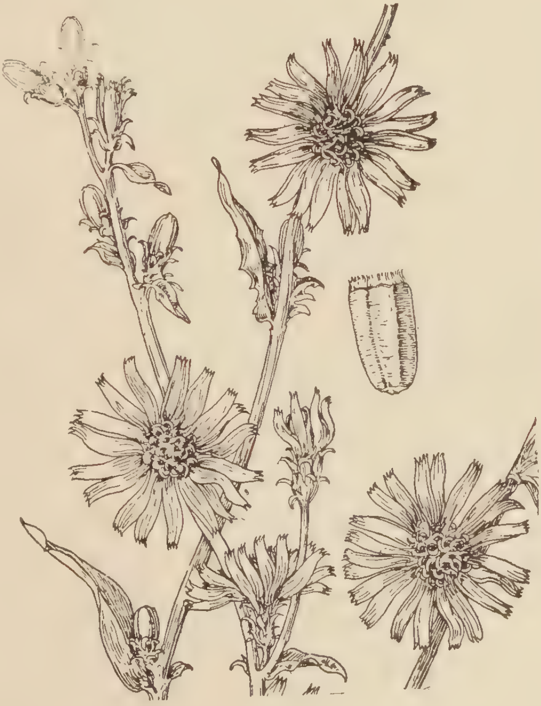
The Gum Plant was probably named after a collector, Grindel, and from the peculiar position of most of the leaves, at nearly right angles to the stems. They thus are "square" with it, so the plant is named Grindelia squarrosa. The most noticeable feature is the large amount of balsam, or gum, in the stems, leaves, and especially the flower heads. This gum is a protection against insects and browsing animals; even if the crawling larvæ gets up to the gummy involucre, it will be baffled at last before reaching the flower. For the leaves not only stand out straight, but also clasp the stem more than half way around, and thus impede the progress of the larva that tries to climb it. Finally, the involucre, or cup that holds the flowers, has its scales formed into recurved hooks, making a bur, which is also very gummy. The seeds of the gum plant are sweet, like those of the sunflower, and are much relished by various animals. One moth lays its egg among the flowers, and the larva that hatches from it usually eats all the seeds before it transforms into a moth. The florets are brilliant yellow, the rays numerous and narrow. This plant is used as a cure for poisoning by ivy and for asthma. Leaves and flowers bring from 5 to 12 cents per pound. In pioneer days it was called arnica, and its juice was employed for bandaging wounds and burns; also a cure for ivy.

Yarrow is a common weed used in medicine as a tonic; the odor is strong and aromatic; the taste, sharp and bitter, tainting milk if eaten by cows. It is about 10 to 20 inches in height, its numerous dark-green, feathery leaves divided into very fine, crowded parts. The flowers numerous, from June to September, small, white (sometimes rose-colored), and crowded in dense, flat-topped heads.



Yarrow, at the left, has numerous heads of small white flowers, each a composite with both ray and disc florets surrounded by an involucree. The oyster plant at the right is 2 to 4 feet high: purple ray florets, disk flowers none, flower stems hollow, juice milky, pappus feathery, rusty, with brownish hairs, borne at the end of a long beak like that on the seed of the dandelion.

Western Thistle (above); flowers purplish white, leaves prickly. Rabbit Bush at left, yellow flowers without rays, used in pioneer days for making brilliant yellow and reddish dyes. Both drawn from nature by grade pupils of Normal Training School.



Chicory is a plant escaped from cultivation; it is pervaded by a milky juice, and has stiff, rough stems and bright blue flowers. Its roots are used as a substitute for coffee or to mix with coffee. The leaves are long and narrow. The family to which the chicory belongs is called the sunflower, thistle, aster, or composite famly, or the Compositæ. The flowers are in a dense head, surrounded by a cup of green scales called the involucre. In our region, this family comprises about 1-3 of all our flowering plants, many of them blooming in fall or late summer. In all countries 11,450 species of this family are known. The flowers are produced in heads; the anthers are united into a tube which surrounds the style; there is only one seed to a flower. In this order are found large numbers of showy flowers in cultivation, such as asters, dahlias, chrysanthemums. This order makes also the largest contributions to the weeds that is made by any family. To the vegetable garden the best it can do is to furnish lettuce, chicory, artichokes, sunflowers. It does not furnish a single plant of importance for meadows or pastures, except yarrow, which takes a low rank for meadow, pasture, and lawn, and is used in medicine.

c. Winter Reading.

THE WAY OF AN INDIAN.

(Traits of the Midland Tribes.)

Sol Hale peeped out of the open doorway of the log cabin and instantly his brown eyes opened wider, for they rested on two Indians swiftly approaching. Ahead strode a tall buck clothed in the ornaments and head dress of a chief; behind him waddled a young squaw, evidently footsore.

"See, who's here!" exclaimed the ten-year-old boy, as his uncle Thomas Hale, stepped forward to confront the chief while the four little Hales sought protection in their mother's skirts. The appearance of strange Indians at a lone cabin in the far West in the early fifties might mean many things, and it was not for nothing that the broad-shouldered pioneer, Thomas Hale, had earned his title of "Sadiods," Wolf Dog, among the Indians. This man could fight like the gray wolf when necessity demanded it. The Snake Indians and the Utes were at war, but the two fagged travelers, covered with dust, evidently were not hostile. Nevertheless Thomas Hale filled the doorway with his broad shoulders as he sternly demanded, "What do you want?'

"Rest. I am a Ute chief, and the Snakes are after me," replied the guest in broken English. "White Dove, my squaw, can go no further."

"Let the poor thing in, Tom," interposed his wife, while tiny

Mary piped, "Look at the little papoose," as she espied a droopy brown head on the squaw's back.

There was nothing white about White Dove except her name and the alkali that fringed her eye-lashes; she was as flat-footed and meal-baggy as most squaws, for "beautiful Indian maidens" exist only in songs composed on Broadway. But she was young and was held dear by her master. Scarcely had the visitors been given water, while the little Hales crowded around the brown baby, when their cousin called out from the window, "There are one, two, three —five horsemen rounding the bluff."

"Ugh," grunted Ankotowat stoically, "the Snakes come quick. They will kill us." White Dove looked around with a hunted look. Tom Hale gave one glance at the approaching redskins, then his gaze wandered around the cabin. One room, built of logs, plastered with mud, and with scant furniture, it offered no hiding place for two full-grown people. A board creaked under his foot. That gave him an idea. Stooping, he opened the trap door to the potato pit under the floor. He pointed to the black abyss. Instantly Ankotowata leaped into the hole and pulled his wife and baby after him. A moment later the hatchway was shut on them, the table hastily pulled over it, and Hale advanced leisurely to the door as the band of Indians drew up. Their bare shoulders shone like burnished copper as they curveted on their ponies.

"Have two Indians passed this way?" asked the leader.

"Yes," replied Sadiods deliberately. "They went through here some time ago and went on."

The horseman searched the alkali prairie and his eye rested on a clump of cedars that huddled against the foothills.

"They must have gone far," he grunted. "Yes, they must be in the cedars." A triumphant gleam leaped into his eyes. Like a huntsman now sure of his quarry he dashed on. The others silently followed. As the inmates of the cabin saw the file of Indians swallowed up by a cloud of dust, it seemed that their hearts resumed beating. Even stalwart Hale himself heaved a visible sigh of relief as he turned from the window. Little Sol dashed eagerly under the table to open the trap door, but his uncle restrained him.

"Wait a few minutes, my boy," he advised.

When the prisoners were let out of the dark hole they were told that their pursuers were far in the distance.

"It is good," said the chief simply. "The man who spoke was

Tewana. Had he found us it would have been torture and death for me, and worse for White Dove here."

In reply to eager questions plied while he partook of their humble fare, the Indian told his story. "Three years ago the Snakes and my people were at war. I led a party of young Utes to the north to reconoiter. I was bitten by a rattlesnake and became so ill that I thought I was going to die. I urged my young men to go on and leave me, for we were in the enemy's country surrounded on all sides. There were only twenty of us, and a few hours delay might mean death to the whole party. After a brief parley they unwillingly consented to go on. So I was left to die alone. It transpired that I was the only one that lived, for the whole band was wiped out by the Snakes further on. An Indian, this same Tewana, found me and took me to the hostile camp. There he gave me to his sweetheart, the chief's daughter, to be nursed. White Dove called in the medicine man and together they worked with me. I got better, and as my strength grew, so did my love for the girl increase. And she loved me. At first Tewana was busy with his war parties, but he began to watch with jealous eyes and he stirred up hostile feelings against me. 'We have nursed this viper until he has waxed strong, but still does he eat of our meat and warm himself at our fire,' he murmured. Then I went boldly to old Chief Fish Hawk and asked him for his daughter. "You come empty handed, and Tewana here has brought much wealth, piles of skins, many ornaments, heaps of buffalo robes. Tomorrow she shall marry Tewana. Bah—you are a Ute.' White Dove looked up startled while she toyed with the string of shells I had given her, and Tewana laughed. Then the old chief called his braves and they drove me from the camp. But that night I went back and stole White Dove from their midst, for she was mine. Again my people and theirs are at war, and Tewana has not forgotten. We were alone and hard-pressed, for White Dove cannot travel fast with the papoose, and you protected us. Ankotowat shall not forget."

When the Indians left, Hale gave the chief a note to a trader at a neighboring post who would help them, and young Sol Hale went part of the distance to show them the way. The foot sore squaw had tucked away in her blanket a loaf of mother Hale's coarse bread.

* * * * * * * * * * * *

Five years had elapsed and war had broken out between the

Utes and the white settlers. A family had been massacred in the mountains and a six year old girl had carried the news to their nearest neighbor, four miles away. The men of Cedar Valley gathered up their families and hastily departed for the block house. It was a motley and terrorized crowd that overran the inadequate accommodations; rough, masterful men, hard faced women showing the marks of toil, illy clad children. The trouble had come upon them at a bad time, when nothing was left of the last year's harvest and they were gaunt from the winter. Their ammunition was low and they were in no way prepared for a siege. To add to their consternation it was discovered that both the horses and the cows were gone from the common pasture. Had they strayed or been driven off by the Indians? They feared the latter. On one they were dependent for safety, on the other for food. It was decided to send someone after them. They discussed the question as to who should go. There were fewer men than women and children, and not a man there but had several souls dependent on him.

"Even though the Indians have got them we cannot send a company, for the men cannot be spared from the block house. Some one will have to go and see if he can locate them. Will anyone volunteer?" asked an old man. There was silence. To go meant almost certain death, and every man shrank from leaving his loved ones to the hazards of the frontier.

"I will go." Several started up guiltily to see that it was fifteen-year-old Sol Hale who had spoken. Why not? The boy was an orphan and he could do it as well as a man.

"I say it's not right to send the kid. I'll go myself," interposed burley George Swenson, whereupon his old mother began to moan and his pretty young wife came and threw her arms around his neck. So Sol Hale went after all. Just as he was leaving, John Bailey, the braggart of the company, called out derisively: "If you bring back my two horses, I'll give you my spurs." Sol's heart leaped. He had often admired the shiny, glittering things that had once belonged to a Mexican vaquero. To have them for his own! Trappings were scarce among the pioneers. Of the colony's band of thirty-five horses, only two remained, Mayflower, so called on account of her age, and a calico pony that had been used as a pack animal. The boy chose the latter. More than one prayer for his success went with him as he started out. The chill March wind whistled through his thin little blue coat and the pat of Dutch cheese, his sole provisions, in his breast pocket, lay a damp lump against his chest. All afternoon he traveled straining his ears for the bell mare until the very silence seemed to tinkle with a thousand tongues. In the evening he had got up where spruce and pine cast dull shadows on patches of snow. He wended his way through the gloomy trees until darkness shut him in. He could go no further. He dismounted. The snow had been melting and it squshed through his ragged shoes to his numb feet. He was tired and hungry and scared and real noises now added to his terror. An owl kept calling "Who" and though Sol had heard owls before he never thought its call sounded like that; coyotes barked and he shook with the cold when he heard the long-drawn-out howl of a wolf; once he thought that he heard the voices of Indians, then he saw a ghost. He was just about to collapse when it let out a gentle "moo." The ghost was Mollie, the old white cow. She must have been surprised for he threw his arms around her and patted her like a long lost friend. The coming of the old cow cheered his drooping spirits, for youth revives easily. The finding of the old cow meant perhaps the end of his quest, for if the stock was here, the horses were perhaps not far distant. As her calf came ambling up he caught it and tied its legs. "If I keep her calf, I'll keep Moll and then perhaps the rest of the cows will stay around; it'll be safer from the coyotes anyway," he figured.

He crouched under the cow and milked the fluid into his mouth. It was awkward but the warm stream felt grateful in his throat. Then he must have fallen asleep, for when he started up the gray dawn was streaming through the trees. He led his horse to a clearing. He stopped. Was that a thin reel of smoke curling up above the trees? He lowered his eyes and looked straight into the muzzle of a gun. Presently the Indian holding the gun came up. He made signs for Sol to remount and taking the horse by the bridle he led it in among the trees. To his surprise Sol found that he had spent the night within a stone's throw of an Indian camp. Around the smoke of a green fire the bucks still drowsed in their blankets while the squaws were preparing the corn in their metates for breakfast. The sides of a newly slaughtered beef hung from a tree. Sol rightly judged it to be one of the settler's cows. A surly looking Indian came up.

"What do you want?" he demanded.

"I came after my people's horses," answered the boy with a boldness he was far from feeling.

"Is it likely that the white men would send a child?" he grunted. Two others had now come up and they fell to discussing him in the vernacular. Sol felt sure that they were deciding how to kill him. All the tales of cruelty and torture that he had ever heard seemed beating through his brain. When one of them pointed to the fire he thought that they meant to burn him alive. One of them yanked him down and pulled off his little blue coat. They fell to dividing its brass buttons between them. Then they took his belt and his pocket knife. When **that** went he could not suppress a sob. A big Indian roused from the fire, pulled his blanket around him and slowly approached.

"What is this?" he demanded. "A spy." The newcomer was evidently a chief for his headdress of pure white plumes reached clear to his feet. Something about him seemed familiar to Sol. Suddenly it came to him. He was Ankotowat, the refugee whom his uncle had hidden in the potato cellar.

"Sadiods wants his horses," ventured the boy.

"You lie, Sadiods is dead," replied the chief. True, the boy's uncle, Thomas Hale, had died of the fever two years before.

"Yes, Sadiods is dead, but he has left a squaw and six little papooses, and they haven't any horses." The red man seemed to be considering this, so Sol added, "I trust that White Dove is well."

"White Dove sleeps too. We buried her there on her horse, as became a chief's daughter." Sol looked at the Ute grave yard, a mass of boulders extending up the side of the hill. They had strangled the horse, placed the body upright on it, placed it in a hollow and then rolled boulders on it from above to protect it from the coyotes.

Taking his eyes from the place Ankotowat asked, "How many horses had Sadiod's people?"

"Thirty-three."

"Would you know them?"

"Yes."

"Then come this way."

He led him down a trail and at a turn disclosed to the boy's astonished view a basin surrounded on all sides by high embankments; this natural corral was full of horses. Sol judged there were sixty head.

"Can you pick out the horses?" asked the Indian giving him a sharp look.

"Certainly."

"Then we'll have them driven out."

Sol indicated first the bell mare. As she was driven out the others followed her and as each filed past Sol would nod his head. "Yes, Sadiods' horse." Finally came a big fine bay horse from Lehi. The boy reflected how glad the people would be to get him back and he hated to leave it with the Indians. He gulped and then said, "No, that belongs to the people of Lehi."

"Right," said the Indian. If the boy had lied he might have lost all the horses.

When the thirty-three head of the people of the settlement had been driven out Ankotowat turned them over to the boy, "Sadiods did me a favor and an Indian never forgets. Now take the horses back to your people."

Sol scarcely knew how to thank him and mounting his pony he drove the horses out rejoicing, amid the surly glances of the other Indians. There was much relief and joy at the blockhouse when Sol reached there with the horses. He told his story and then turning to John Bailey he asked for the spurs. The man turned on him. "I don't believe any such fairy yarn. You've been playing over in Lehi with the boys and you found the horses on the range, and brought them back. You don't get the spurs."

Sol turned, his eyes full of tears, unable to hide his disappointment.

"What," spoke up Thomas Hale's widow, a strong faced pioneer woman. "Shall an Indian keep his word and not a white man? Never mind Sol, I'll give you your uncle's little saddle."

The boy's eyes glistened, for of all things did he want that most.

OVER THE WATERFALL.

(Traits of Northern Tribes.)

Arropine was a Bannock taken captive by the Blackfeet. He was wounded in battle, and they hoped to exchange him for horses. Samos, the medicine man, took charge of him, That the cut in his shoulder healed so soon was due to his own good health rather than to the skill of Samos. At first, when he was weak, he had been set to help the squaws grind corn, dress meat, and broil fish. Then, because the tepee poles were heavy, he set them up for Blue Feather, a good looking young girl. He did this with such good grace that she smiled at him, for Indian gallantry is unusual; but the old squaws shook their heads and scowled over such behavior. As his strength came back, Arropine went out with hunting parties. He was clever at trapping and killing wild animals, and soon became the leader. This aroused the jealousy of the principal Blackfeet hunters, especially Rain-in-the-Face, who hated to see a Bannock surpass him with bow and arrow. He discovered that the captive was taking the softest buffalo robes and the choicest cuts of venison to the tent of Black Hawk, Blue Feather's father. This was the maid that Rain-in-the-Face had selected for his wife. The winter had been a starving one; the corn and the dried meat were all gone, the ice was so thick on the streams that they could not cut through it to get the fish, and even rabbits were scarce. But Arropine had gone out alone and brought back a young bear, and the whole tribe had feasted. When summer had let loose the streams and fanned the hillsides into bloom, the wily old Black Hawk decided to sell his daughter to the highest bidder before another winter should come. He was poor and had little besides his handsome daughter, so he was anxious that she make a good match. He consulted Bull Moose, the chief of the tribe. The two smoked long in silence; the chief finally said: "Blue Feather is good looking and many of the young braves will want her. She would grace a chief's tepee. Tomorrow we will have it proclaimed that you will receive offers for her hand. Within seven suns, the young men shall come before you with their presents."

While the old men were in council, Blue Feather and Arropine were riding over the hills, she on an Indian pony, and he on a wild horse he had caught and tamed. He had got her a blue-bird's wing to fasten at the back of the beaded thong that bound her black hair. As they rode, she compared his well-fed, rounded figure with those of the scrawny Blackfeet. She was sorry that he was a Bannock. The next day she heard that she was to be married. In vain did she plead with her father that she was too young, was not ready, and there was no one she wanted. She crouched in the tent in misery until night. When she heard the old man snoring, she slipped out and made her way down to the river. Half way down the rocky path she turned and saw a tall form behind her. She gasped with relief when she recognized Arropine. His face looked drawn. They sat on some huge boulders by the stream. It was she who first spoke: "You heard I was to be married?"

"Who do you think it will be?" he asked.

"I do not know. I hate them all, but I would like to see who will pay the most for me. There is Rain-in-the-Face. He looks at me sometimes, when he forgets about himself for a few moments. He is a great boaster, and is evil and cunning; but he schemes and gets everything he wants. Then there is Samos, the medicine man. He is toothless and old and has buried two wives already. He is so ugly that I don't wonder that he puts on the masks of animals when he performs his rites. He is rich, for he makes all the tribe give him their treasures, but he hates to part with them. He is so stingy that he would not give much even for a young wife." She laughed. "Then there is Langsham, the picture writer. He has far-away eyes and says little, but he made some pictures of me on his buckskin. How should I know?"

Arropine spoke bitterly. "In my own tribe I am a warrior and the son of a chief. I have many horses and heaps of buffalo robes, but here, I am nothing."

"Not for all your wealth or even the white man's guns would my father give me to a Bannock, for with our tribes it is war to the death."

"I have nothing for your father, but these I can give to you;" and he fastened a string of elk's teeth about her neck. As he did so, he stooped and kissed her. The memory of that kiss helped to cheer her in the trying days that followed. One week later most of the Indians gathered around the tent of Black Hawk to witness the bids for his daughter's hand. Blue Feather, decked in her best, looked sulkily on. First came a young Indian leading two handsome horses. They were presents, he explained, from Rain-in-the-Face, who aspired to the hand of the old man's daughter. Already a huge pile of buffalo robes and blankets from the same source had been deposited by the tent. Last came Rain-in-the-Face himself, a lithe, slim Indian with furrows of craft and cunning across his face. He was a leader, and, like most big men, he would pay almost any price for something he wanted. He bore an armful of rare and costly furs, trophies of his trip to the far north. There was sealskin and otter, silver fox, mink and ermine that would have decked the robe of a king. Black Hawk's eyes glistened and even Blue Feather looked up with interest when, last of all, he held up a woman's buckskin gown beautifully embroidered with beads. Next came old Samos, the medicine man. He also gave a horse, a poor scrawny animal, and a heap of mangy furs. He relied much on his influence with the tribe, and made a speech in which he intimated what a great honor it would be to become the squaw of the medicine man. He wound up by saying that the spirits had decreed that she marry him. This caused a superstitious murmur among the onlookers.

Last Langsham, the picture writer, presented to Black Hawk some beautifully decorated pottery, head dresses made of feathers, shell work, and many deerskins with much writing and many pictures on them; but Black Hawk spurned these gifts with his foot, and said they were like woman's work. The artist was sensitive and shrank back abashed; but Blue Feather gave him a sympathetic look, for of the three she liked him best.

"Is there any one else who aspires to the hand of Blue Feather?" asked Chief Bull Moose.

"I do;" and all looked surprised to see the Bannock prisoner, Arropine, stand forth.

"And what have you to offer?" jeered Black Hawk.

"Nothing. But I will get as much as all this put together," he replied haughtily.

"It is like a Bannock to bring nothing but empty promises," sneered the old man, although he knew well that Arropine had had no chance to get anything while a prisoner of war.

"I would rather see my daughter dead at my feet than become the squaw of such as you." Then, still angry, he turned to Samos. "As for you, it is well known that you are rich, yet you would try to cheat an old man, and not pay a fair price for a woman. "I give the girl to Rain-in-the-Face."

The last named brave strutted triumphanty, but Blue Feather only hung her head. All eyes were fastened on Chief Bull Moose who addressed Arropine: "We took you in when you were sick and we fed you in our lodge, and now you dare to aspire to the hand of a Blackfoot maid. Go, and when you meet your own people tell them that a Blackfoot knows how to be generous."

Arropine turned on his heel and went. That night, Blue Feather crept down to the river by the rocks where she had sat with Arropine. She toyed with the string of elk's teeth that he had given her and wept bitterly that he had given her up so tamely, without even a struggle. She heard a splash, and turned to see a tall form in a canoe. It was Arropine come back for her. He motioned for her to climb in. A moment she hesitated; then stepped in. With broad strokes he drove the canoe into the current. The air was sweet with the scent of the pines and in the moonlight she could scarcely believe that it was not a dream. They left the course of the river and shot out on to a big gray lake. Then Arropine spoke: "Listen, girlie. Beyond this lake lies a land where fire and boiling water burst from the earth. Your people and mine believe that it is haunted by evil spirits so they never go there, but a miserable tribe called the Sheepeaters hide there because they will not fight and they are less afraid of the spirits than they are of our warriors. And the spirits, instead of harming them, have protected them. If we go there, your people will never find us, as we have left no trail. Will you come with me?"

Blue Feather shivered slightly, for she had heard of the dread land that seethed and boiled, but she answered steadfastly, "I will go."

All night he drove the boat with powerful strokes. At daylight they landed where hot springs bubbled out of the ground. Arropine hid the boat under some fallen brush, for it was the fishing canoe of the Blackfeet. Then he caught fish from the lake and cooked them in one of the springs of boiling water. After breakfast they set out through the woods to where the geysers rushed and roared. Great spouts of water were thrown out, some every few minutes, some every hour, others a few times a day. One enormous one went into eruption only once a week; but when it did explode, it filled her with wild terror. There were blue springs of hot water and lakes with rose-colored steam, rising from them. Game was plentiful and Arropine caught fish and brought her venison and bear stakes. At night she would creep up close to him for this strange upheaval of the earth filled her with fear. Arropine had warned her against drinking any but the river water, but one day while he was gone, she tasted some from a purple spring. It made her very ill, and she begged him to take her away.

"I will take you to the land of the waterfall where the golden canyon is, and up in the mountains near the eagles, you will grow well again." So he took her again in the boat across the gray lake. It so chanced that Rain-in-the-Face with a party of warriors on the opposite bank saw the tiny craft and guessed who it was He made his way swiftly to their landing place. When he saw the smoke of their camp fire, he crept up on Arropine and attacked him. The two men were well matched and fought fiercely. Before either was seriously hurt, the young men came up and stopped the fight. They conducted the captives to the Blackfoot encampment nearby. The wise men of the tribe assembled to decide what punishment should be meted out to the bold Bannock. In a cave the aged men sat around the sacred fire. Besides these were the Chief, Black Hawk, Rain-in-the-Face, and Samos. Long the old men sat and smoked in the dark, then Samos flared up the flame.

"We have met to decide what to do with Arropine, a Bannock, who, after eating our meat, stole away the daughter of Black Hawk after she had been given to Rain-in-the-Face, who has captured the robber; let him speak," ordered the Chief.

Now, Rain-in-the-Face had grown up near the waterfall. He had watched the tumbling waters and had often wondered if any one could go over that awful brink and live. He had passed the waterfall that day. On a sudden he spoke. "Let us put him in a canoe and send him over the upper falls. If he lives well be it; if he dies, who can help what the God's destroy?"

"What say the wise men?" asked Bull Moose.

As none of them spoke, he turned to the medicine man. "What says the sacred fire?"

The medicine man knew that if Blue Feather lived he would never get her. He could never forgive an injury, and he remembered the insults the girl and her father had put upon him. Deliberately he spoke: "The spirits say, O Chief, that it is well that the Bannock shall go over the falls. Only, he must not go alone. The woman must share his journey. Let them be bound together. If they live, let them go, if they die—" his voice died off.

Black Hawk broke out in protest, but the councillors said, "Let it be so."

"Only," commanded Bull Moose, "let there be boats to catch the canoe after it comes down lest it be ground to pieces against the rocks, or carried down to the great waterfall," for below the upper falls were the mightly lower falls, over which nothing could go and escape.

The whole tribe assembled to witness the spectacle. Carefully the canoe was prepared, lined with green leaves and soft robes. Blue Feather plaited her hair and donned her best raiment and rarest ornaments. Arropine laid his bow and arrows by his side. Then she bade her father, who seemed suddenly very old, good-bye, and lay down by her chief's side. They bound them together with leather thongs, then covered them over with rawhides. Rain-in-the-Face towed the boat out into mid-stream, cut it loose, and then rowed furiously back lest he, too, be caught in the swift current. The onlookers saw the boat shoot toward the rapids, saw a black speck on the brink, saw it leep the falls, and a moment later subside into a quiet pool below. Eagerly it was pulled ashore. Langsham, old Black Hawk, and Samos, were the first to reach its side. Black Hawk drew back, afraid to look, so Langsham lifted the cover. Samos peered anxiously to see the result of his experiment.

"She lives," cried Langsham, throwing up his arms. He tore the covers off, cut the thongs, and lifted up the unconscious girl. Arropine, who was unhurt, arose and stretched his muscles. After resting a little, the two were permitted to take their departure for the Bannocks in the North. Arropine knew all about the Yellowstone, and later acted as a guide for Jim Bridger, when the white trapper went to explore the wonders of geyserland.

THE BAT BASKET.

(Ways of Southern Indians.)

Four squaws sat on the shady side of a sun-baked mud house in the Hopi village of Kwia. They were weaving baskets of the tulle rush. Three of them worked with brown and white straw; the other's was a pale lavender. The latter grew only in one place and was tinted by the mineral in the water; the secret of its hiding place was known only to Ramona, the weaver of the star basket. The baskets were nearing completion, and as they worked they talked lazily; for it was a hot afternoon in mid-August, and mingled with the drone of their voices rose the buzz of innumerable flies. Aki, the eldest of the four, was a little shriveled up old woman, toothless, and with a face lined with innumerable wrinkles. Wawa and Ramona were middle aged and mostly run to fat. They wore dirty calico dresses. Dolores, the youngest of the quartet, was cleaner than the others. Her sleek black hair was done in the Hopi style of fan-shaped rolls at the side of her head, and her feet were enceased in beaded moccasins. She wore a calico dress except when she went over to the Harvey House at Albuquerque to weave blankets for the benefit of eager tourists, who unloaded from the train to "see the squaws actually at work upon Navajo blankets." On these occasions she fixed up in beads and gaily colored blankets. Leaning against a nearby wall, watching Dolores, stood

Juan, a good looking Navajo lazily rolling a cigaret. She, for her part, did not seem to know he was there. Since they had quarreled down by the spring a moon since, they were not on speaking terms. At that time he called her "a rattlesnake," and he noted with amusement that she was weaving a rattlesnake design into her basket. The body of the snake coiled upward around the basket in brown and white checks. She was working on the head at the top of the basket, the most delicate part of the task, and he noted that she gave it a vicious jerk as she worked on the distended fangs. Except for an ultra sun-burned countenance and the string of Elk's teeth around his neck, Juan might have been a young white vaquero in sombrero, flannel shirt, and overalls.

The Hopi village basked in the glare of the brilliant sunlight of the southwest. To the east stretched the mesa—a barren waste of sand and mesquite bounded by the roseate terraces of the painted desert. Far to the south extended the green ribbon of the river of the green rocks, banked by its cottonwoods. To the west was a green spot which marked the spring where the Indian girls did their washing and whence they carried their drinking water in colored ollas. Behind the town rose a rocky eminence. Above all, vaulted the brazen sky. The houses were built of sun-dried adobes plastered over. Some were of two stories, others of one. All had flat roofs surrounded by parapets. The upper stories were reached by ladders constructed of poles—a survival of the cliff dwellers. The windows were only bare apertures, but in the doorways hung mats of woven rush or blankets of rare dyes, which would have been the envy of a connossieur. Upon the yellow roofs were strings of red peppers drying, and along the walls stood varicolored clay jars. In a nearby doorway a young girl was pounding corn in a metate. Suddenly the pack of mongrel curs of the Indian village began to yelp,—an invariable sign that some one was approaching. The basket weavers, always alert for a possible purchaser, glanced up to behold two figures on horesback approaching. One was a man with a black beard; the other the tall, lanky, woman who taught laundry over at the government school. The Indians knew and liked her. When they reined up, the lady teacher interpreted for the man.

"This man is from the big school in California. He loves the Indians and buys many baskets."

Wawa grunted. She had heard of him before.

"He will buy your baskets and pay you a good price for them, only you must tell him what the designs are about. He says that he will buy no baskets unless the Indian woman tells him what they mean."

The eyes of Wawa and Ramona lit with cupidity; but Aki, the old woman hugged her finished basket to her shriveled breast, and Dolores went on working doggedly at hers without glancing up. The Indian is taciturn about divulging her secrets to the white man, but with infinite tact and patience the school teacher wormed their stories out of them.

"Mine," said old Aki, holding hers up and displaying a series of figures like queer birds, "is not for sale. It is a prayer basket. At night when I lie down I can not sleep. I lie long hours in the dark longing for sleep to come, and then the bats fly in through the windows and they beat their wings and flap around and I can not sleep at all. Other old people can not sleep much and wake early in the morning, but I cannot sleep the fore part of the night for the horror of the bats. So I thought, 'I will weave a basket with the figure of the bat on it and I will fill it with food and take it up among the rocks to the prayer place and pray that the bats may leave and let me sleep.'"

The man sympathized with the old woman, for he too suffered from sleeplessness, but here was an unusual story and he especially wanted the basket. "If you will let me have the basket," he said, "I shall send a man who will fix screens on your windows that will keep the bats out and the flies and mosquitoes as well. And I too will pray that you may sleep."

The man's eyes looked kind. The old woman held out her basket impulsively to the school teacher. "Tell him he may have it. There is no price. I trust that our prayers will be answered. I am very tired."

Wawa bustled with importance as they turned to her. Her basket displayed an incongruous figure of a man, an animal, and something else, the nature of which could not be determined at first sight.

"What is it all about?" asked the Californian.

"Well, you see, Wawa here, owns an animal of which she is very proud, a mouse-colored burro named Tobi. She uses him to carry sticks with, and to bring up water from the spring. Once when she was at a railroad station she saw a white man's donkey feeding out of a trough. Since then the poor Indian woman's chief ambition has been to become rich enough for her donkey to feed out of a trough like the white man's.

Mr. James dug down into his pocket and fished up a handful of silver. "Tell her to buy her donkey a trough," he said.

As they turned to Ramona, her fat face took on as spiritual a look as its pock marks and flat nose would allow. The bottom of her basket was one immense star. At the sides between the points of this twinkled innumerable little white stars on a lavender background.

"When my husband was killed by that bad Mexican, Lopez, the good padre told me that he had gone to heaven. So at night I lie and think of him way up among the stars, only they seem so far away. Then a calm comes on me and I try to wait until I shall go up there to him."

"This," exclaimed the American as he picked up the basket that Dolores held listlessly, "is a most unusual design. I have never seen one like it before. How did you come to weave the snake into your basket, my girl?"

"Always have I been in awe of the rattlesnake. It would bite people and they would die. Once in the canyon it bit a calico pony and it was dead in an hour. Only once came a young American across the desert. A rattler bit him in the leg and he cut open the place with his knife and sucked it. Then he drank the white man's fire water and went and lay in the mud where the hot spring gushes from the ground. He got better. Then one morning about a month ago, as I came up the path thinking how I should make my new basket, I saw a rattlesnake as big around as my arm lying under a squaw-berry bush. I crushed its head with a rock. Then I sat and looked long at it and thought 'It is an omen. I shall put it into my basket.' " She said nothing of her quarrel with Juan.

"And how much do you want for it?" asked the collector trying to hide the eagerness in his voice, for it would be the star basket in his whole collection. "I did not make it to sell," she said glancing over at Juan who had come up. She added slowly, "It is for the best snake dancer in the tribe. You must buy it of him." She indicated Juan. Juan's glittering teeth showed in the first smile that had lighted his face for a month. "Give her the money," he ordered.

After the white man and woman had disappeared in a cloud of dust, Juan crept up to the side of Dolores and whispered, "You must let me return your gift." He held out a very beautifully wrought belt made of the skin of a rattlesnake. So in the twilight they wandered down to the spring to mend their friendship where they had broken it a month before. And in the Hopi village old Aki's windows alone had screens on them and the bats bothered her no more.

THE HOUSE MOUSE.

George knew that there was no canary bird in his home, yet, as he sat alone in the house one bright afternoon, he heard a sharp, squeaky trill in the pantry. Unafraid of the strange sound, which he felt sure must have come from a canary owned by the neighbors, he went on tiptoe towards it. There, sitting on its hind legs on a shelf, singing with all its might as if it were a bird, was a house mouse. Did you ever hear a mouse sing? If you watch closely, you may some day, for one lady once owned a mouse which sang as many as eight different notes. Some men say that the mouse is in pain when it sings, but others insist that it sings because it is happy.

Look closely at the next house mouse you catch in the trap. Notice his long tail, large ears, long nose, and grayish brown color. for then you can tell him from other kinds of mice. Other mice are usually of light color below, and their tails and noses are short. The tree mouse, for instance, has two well defined colors even on the tail. A mouse's tail is not bare, but is really covered with tiny hairs which keep off the wet; but if you catch a mouse by the tail, the whole skin of the tail may slip off in your fingers and the mouse will get away. Five or six young mice are born in a mouse family every month of the year. The tiny little ones are weaned when they are two weeks old. When they are two and a half months old, they go off in pairs to make homes for themselves. The young ones at birth are no longer than blue-bottle flies, and they are so pink and delicate that you could almost see through them if you held them up to the light.

The house mouse was found first in Asia; but it is now seen all over the world. It will eat anything it can find in the pantry, but in the winter lives almost entirely on insects such a spiders, flies and wasps, which have nestled in the cracks under the floor. If you put a live mouse in a bee hive it will nearly drive the little honey-makers crazy before they all get out. It can jump a long way and even climb up walls. If it cannot reach over the side of a cream bowl it will stand aside and flip its tail into the dish and then eat the cream off its tail. Some say, however, that it can do without water at all.

LITTLE BROWN BAT.

One evening in June a lad, who lived near, brought me a bat which he had chanced to strike down with a whip as it was about to fly past him. Clinging to it were two tiny baby bats, blind, helpless, but undisturbed by the fate of their mother, who was dead. Young bats cling to their mother's body for thirteen days after birth. They hold on with their mouths, just as a calf might cling to its mother's teat. During these thirteen days the baby bats sleep with their mother, and at night are carried about with her as she flies in search of insects. Though the body of a little brown bat is only three inches long, the spread of its wings is from nine to ten inches. In flight it is easily distinguished by its small size and jerky course. The famous Mammoth cave of Kentucky is filled with bats of this kind, for it is their habit to gather in such big, dark places and keep each other warm.

The voice of a bat is a fine squeak, thinner than that of a mouse. When captured, a bat will utter a volley of these squeaks together, with a fizzing sound such as a soda-water bottle will make when the cork is loose. So shrill is the squeak of a bat that some people cannot hear it at all; in fact, some persons, who can hear ordinary sounds as well as anyone, cannot hear a piano note four octaves above middle E. Thin and delicate as the voice of a bat is, it probably has several variations, and it becomes even a song during the bat's season of courting its mate.

Young bats are born in June. After they are thirteen days old, the mother leaves them at home, hanging comfortably in a dark room. When about fifty days old, the little ones begin to eat cockroaches or similar food; and at two months, when they are weaned, each one will easily eat from 37 to 40 of these harmful insects. No nest is ever made; the mother keeps hanging the little ones up until they are three months old, when they fly and forage for themselves. The father never takes any interest in the family. A bat's **sense of touch** is marvelous. Scientists have seen them fly about with their eyes out, without hitting anything. One man pasted plaster over a bat's eyes and kept the plaster on for a year; during all that time the bat flew about and dodged even strings hung close together from the ceiling. In some way a bat can tell when it is approaching an object, even though its eyes are taken out. A bat's wing is a continuous piece of skin without any holes in it. This may account for the fact that its flight is silent, while the flight of a bird is not. The slow, easy-going owl is the only bird that can approach the bat's perfection of flight. Bats **live on insects.** They are all the time catching on the wing or picking from bushes these enemies of man. For this reason no boy should ever shoot a bat. Like cats, bats lick themselves all over, sometimes covering their heads with their wings in making the bath complete. When ready for sleep, they alight on the little arm-hooks on the edges of their wings, secure their feet, and then turn down, letting their heads hang low; they shiver for a moment and then slumber. Bats seem to be immune to poison, at least in small doses. To a certain extent they **hibernate**, that is, sleep during the winter; but they do not go into so deep a sleep that a warm day cannot bring them forth again. They have few enemies, as they fly at a time when nearly all nature is sleeping. Owls, however, sometimes catch them; but their greatest tormentors are lice, for these pests flourish in their warm retreats.

THE COTTONTAIL.

Every bush was mantled with snow and even leafless twigs were hung with bright bits of ice. Grass blades jingled with frozen stiffness where my feet trod. All nature was cold and dreary. At the side of the pathway little footprints led under a big bush, which hung over a little waterfall. Soon out hopped a cottontail rabbit, the only live thing seen in the woods that morning. Meek and timid by nature, the little cottontail is still one of the most pleasing of our field friends. As he dashes about from bush to bush, resting every second or so to peek at you between the branches, he tries the skill of the best hunter to catch him.

The soles of his feet are not bare like those of other rodents, but are covered with hair. Hence the tracks he makes in the snow are not sharp and clean cut like those of a dog. Open a rabbit's mouth, and on the upper jaw behind the two big front teeth you will find another pair of teeth, too high to be of any use to him in eating. Perhaps the rabbits of thousands of years ago had four large front teeth instead of two. A rabbit's front feet will not bend towards his mouth as you would bend your hand; in fact they are of no use at all to him in feeding. He can, however, use them well in running and in stamping the ground when angry.

Winter and summer the cottontail feeds about his favorite bush; but if he is not alert, a big goshawk may swoop down and carry him away. This hawk has a habit of walking behind the cottontail to scare the little rabbit out into the open, away from the bushes. If he succeeds, he can then easily fly upon the timid little victim. The cottontail has many other enemies. If he scampers away to his burrow, a weasel, a skunk, or a mink may crawl in after him there. The favorite home of the cottontail is in some briar-covered berry patch, a ravine filled with sage brush, or a creek bottom filled with thick bushes. In summer he eats grasses, fruits, and vegetables of all kinds, but in winter is glad to take dead grasses, buds, bark, and sometimes even cedar and spruce leaves. Young cottontails will drink milk; but the full grown rabbits probably never drink anything, depending on the early morning dew for moisture. When it is snowing very hard, the cottontail will stay in his burrow for days, allowing the snow to drift over him and never coming forth until he knows that the weather is bright again. If in great fear of something, he will utter a shrill squeal but never when in great pain. He will try to escape notice by crouching motionless and will not scamper out of the way until he thinks you are actually going to tramp on him.

THE AMERICAN TOAD.

Things at first ugly may soon interest and stimulate us to practical work. One leading question today is: Shall the American toad be domesticated and cared for in the gardens and orchards of this country? This is now recommended by certain wise men.

An English gardener of wide experience in Australia recently arrived in New York as a salesman of toads. He hopes within two years to prove to the people of the United States that they have one of the best friends in the toad,—a friend who is harmless and who never created a wart on a human being. In the localities most afflicted with insect pests, the gardener will start farms. On each farm he expects to raise one million toads. He sells the toads at 25 cents each.

"It is amazing," he says, "how farmers, even with all the government aid they receive in agricultural education, know so little about the value of the common toad, or how much this useful creature deserves encouragement and protection." He advocates the organization of a society for the protection of the toad. Cutworms are its favorite food. Every year these worms destroy millions of dollars' worth of wheat and rye stalks. The toad devours, besides the cutworms, the tent caterpillar, the weevil, the grasshopper and the cricket. All these insects are farm foes.

The food capacity of this animal is prodigious. In the stomach of one ordinary-sized toad 77 of the thousand-legged worms (Myriapods) were found; in another, 22 gypsy moth caterpillars; in another, 90 rosebugs. All these had been eaten within seven hours. It is estimated that one toad will devour in thirty days 700 cutworms, 1,000 ants, 150 weevils, 140 ground beetles, and 600 myriapods. These are harmful insects, and nature seems to have created in the toad an appetite for them rather than for the beneficial lady bugs and dragon flies. As a destroyer of snails, sowbugs, weevils, and the injurious forms of animal and insect life that infest greenhouses, there is nothing in the world to compare in value with the common toad. In a Rouen laboratory in France, an uncountable number of snails were exterminated by the introduction of 100 toads and 90 frogs. At Malden, Mass., a collection of orchids valued at $15,000 was severely injured through the attacks of myriapods and sowbugs. Fifty toads were introduced, and the damage from this cause ceased within 15 days. The common greenhouse rose-weevil can be exterminated rapidly by means of toads.

Toads have become scarce merely because they have so many natural enemies and because the schools do their duty so poorly. Some boys stone these harmless and useful creatures. Among the natural enemies of toads are the marsh hawk, owl, crow, ducks, geese, and the guinea fowl. Domestic fowls feed on the tadpole. Thousands of toads are killed by lawn mowers and plows, but there is a terrible slaughter by boys. This is one of the things which the proposed society will deal with.

There is something peculiar and most interesting about the homing instinct of this little understood animal. It lives to a great age, and remains year after year in the same locality. Two toads occupied dooryards in two different towns in Massachusetts for 12 and 23 years respectively. A breeding place may be prepared for toads near a shallow pool of water where the supply is constant. Toads are not amphibious like the frog, and the water is needed only for their eggs and for the tadpoles. Stagnant rather than running water is desired. Some objection to this has been made on the ground that it would be a breeding place for mosquitoes. However, the tadpoles might devour the mosquito larvae; in any case, the young toads will leave the water by midsummer, or before the mosquitoes become abundant, and then the pools may be drained or covered with coal oil. Artificial shelters should be erected for toads in gardens, by digging shallow holes and nearly covering them with a board or flat stone. A good plan is to arouse florists and farmers to the importance of the destruction of noxious insect life. Then establish a farm or a colonizing tract for the breeding of the toad.

The toads that once filled our marshes and hopped familiarly in every garden have gone the way of many other of our natural resources. Here is a golden opportunity for farmers, orchardists, and gardeners to effect the domestication of one more animal—one that some authorities believe would become almost as useful in its economic value, as the cow. Here also is a fine field for the common schools. Pupils can learn something truly practical and at the same time scientific, simply by observing the habits, describing the ways, and providing for the care and shelter of the neglected American toad. For the toad has fine jewels in its head (the lustrous eyes); the manner in which he sheds his skin (and swallows it!) creates more fun than the best performance of the circus clown; while as to his music, so dear to the memory of childhood—who that has heard it could or would forget it?

"Crodunk, crodunk! I'm the wisest frog
That ever lived in this muddy bog;
All know I often say, 'Kerchog,'
Which means that I'm a model frog."

The Horned Toad, harmless, useful, and ugly only as a defense against its enemies, deserves our fullest protection and sympathy. It feeds on insects, and is nature's chief instrument in holding in check those that breed on dry, warm hillsides. Lizards of all kinds are beneficial for the same reason, and should not be killed or harmed. All the smaller snakes perform the same service, and it is a great mistake to kill them off.

In fact, some farmers in Nevada will not kill the rattlesnake, because it does such good service in destroying field mice and gophers. Never kill a toad, horned toad, or small serpent in the West. The Gila monster, a large, hideous lizard, found far southward, is the only dangerous lizard, and the rattlesnake the only dangerous snake we have; and neither will harm you if let alone. They will bite if stepped upon or if annoyed or cornered.

THE MOUNTAIN BLUEBIRD.

"Starred forget-me-nots smile sweetly—
  Ring, blue bell, ring!
Winning eye and heart completely,
  Sing, blue-bird sing.
All among the reeds and rushes,
Where the brook its music hushes,
Bright the gold snap-dragon blushes.—
  Laugh, O murmuring spring."

At Cokeville, Wyoming, on a hunting trip in July, as I sought the Justice of the Peace to procure a hunting license, at his residence on the outskirts of the town, I was astonished at the number of bluebirds flying about. The secret was soon discovered. This man, a bird lover, had placed a dozen or more bird boxes on different fence posts about his home. Though the boxes were not more than three feet from the ground, each was occupied by a happy bluebird family. This man lived in a veritable bluebird paradise. Whether you live in the country or towards the edge of a city, you may pattern after this example. To your surprise, the birds will return each year; in fact, the box will be inhabited each summer thereafter if you see that the birds are undistured.

It is remarkable with what fidelity a male bluebird will defend his domain and how jealous he is of rivals. He will drive off every intruder even though it be one of his own kind; and a pair of bluebirds have been known to hold a nesting box against the interference of a dozen or more impudent and quarrelsome sparrows. Their early arrival gives them an advantage over other migratory birds, but does not relieve them of endless contests with the English sparrows. The nest they make is loosely constructed of soft materials, such as fine grasses, sedges, leaves, hair and feathers; and the whole is seldom so well woven together that it will bear removal or disturbance. The eggs are usually five but sometimes six in number. There are usually three broods in a year; in fact, before the first brood are well able to care for themselves, the female repairs her nest and commences incubation for a second family. The young birds are, however, by no means left to shift for themselves; for her mate is a devoted father, and sometimes may be seen feeding the mother, the half grown young, and the newly hatched babies all at once.

Few boys mistake the bluebird when they see him—his color lead one immediately to the speaking of his true name. The Western species has less brown, and its blue is greener than that of the Eastern species. In habits, the species vary but little.

The Western species is not nearly so arboreal as its Eastern relative, preferring the high mountainous portions of the Great Basin, where trees are scarce and stumps, posts, and cliffs are numerous. The song, too, of our bird is fainter, but just as plaintive and delightsome as that of the Easterner. Few birds do so much good and so little harm as the bluebird; 76% of its food consists of insects and grubs, while the other 24% comprises certain fruits and berries found on the winter trees.

Some birds are more ornately feathered, some are gifted with more enrapturing powers of song, but none are so chaste, so confiding and adorable as the bluebird, the beau ideal of all that flies. Softly he flits into our garden in the Spring, timidly, modestly as it were, beseeching our assistance in the search for some suitable niche or box, delightfully but not obtrusively near us, in which he may take up his summer residence. With affectionate trustfulness and a coy manner, quite in contrast with the arrogant demeanor of the obstreperous sparrow, his mate follows closely upon him, waiting only the oportunity to teach us lessons of the sweetest love and fidelity.

THE RED-WINGED BLACKBIRD.

In sloughs beside the railway tracks, in marshes in the fields, in the willows and rushes of river banks,—in fact, anywhere in our country, where the ground is swampy and grasses, cat tails, or willows are plentiful, there also is the red-winged blackbird, joining his gurgling song with the harsh but musical croak of the big, spotted frog. The blackbird belongs to a notable family—the orioles **(icteridae.)** The bobolink, the cowbird, the meadow lark, and Bullock's oriole ("the hang bird") are all close relatives. The redwing is found all over the United States.

Song.—If the weather is mild, the redwings may arrive in the last of March, but they usually come early in April. They take possession of the tops of poplars or other tall trees near their nesting ground, and chant a chorus so sweet, so deep and penetrating that, even at a distance of a mile, one listens with rapture, and walks filled with an exquisite sense of spring.

To Thoreau, the redwing sang "Conk-a-ree" and Emerson said: "The redwing flutes his "O-ka-lee."

Chapman describes his song as "Kong-quer-ree;" Gibson, "Gl-oogl-eee," and another "Gug-lug-geee." If you have, however, while making hay in the meadow listened for hours to a concert given by a row of redwings perched along the telegraph wires, you will conclude that their songs consist of such delicious, swampy, fluty gurgles, that words cannot adequately express them. When blossoms and green are filling one's heart with serenity and gladness, if a magnificent redwing suddenly appears and flutes his "O-ka-lee," the sound will never be forgotten. It is a sign that nature is once more budding in loveliness.

Nest.—A week or so after the arrival of the males, the females appear, and in May the nesting season begins. The nests are usually neatly woven cups. They consist, on the outside, of rough grasses or weeds, lined on the inside with finer materials of the same nature, or with sedges: The nest is always built either over standing or running water, or on boggy ground. Sometimes, the outer part is interwoven with reeds, which support it; sometimes the whole nest, like that of a Bullock oriole, is suspended from the crotch of a willow or sapling limb; it may be on the ground in a clump of grass. The eggs average about an inch in length; and are of a light, bluish cast, lined, blotched and marked at the larger ends, with light purple and black.

The male bird seems, like Argus, to have a hundred eyes, so vigilant is he in protecting his nests. If an intruder gets too near, he dashes about close overhead, and remonstrates with almost frightening persistence, against the danger to his domain. If the nest be destroyed, he is in great distress for days, but soon builds another in the same place. After raising one or two broods, the birds gather, in August, into flocks; at this time, they are varied in apearance. Young birds, which at first resemble the mother, do not get their full plumage until the third summer. As autumn approaches, they gather in immense numbers previous to their migrations southward. Last fall, I saw a flock of about four thousand individuals gleaning in a grain-field.

Food.—Much has been said against the redwing blackbirds, but they are a benefit to the farmer. In March, April, May, June and July, they feed almost exclusively on obnoxious insects; the number that they destroy in a single season in the United States, is estimated at twelve thousand million! Insects constitute about one-fourth of the redwing's yearly food. In June, it eats many weevils or snout beetles, snails and crustaceans. At other times, it feeds on army worms, crane flies, white grubs, root borers, ants, chinch bugs, root worms, root lice, and green locusts. There is a species of cutworm which is ruinous to swampy grass lands; but if the blackbird is near, the pest is soon done away with. Like the meadow lark, it gormandizes on grasshoppers when that delicacy is in season.

In winter the redwing exists mostly on weed seeds. Ragweed, barn grass, and smartweed are eaten from August to April. It seldom injures the barnyard or orchard; and prefers weed seed to grain. The young are fed exclusively on insects such as plant lice, grub worms, cut worms, and caterpillars. Of course, the blackbird eats some green corn and standing grain; but most of the grain which it takes is gleaned from the fields after the reaper has gone. Charming reminder of spring, the handsome ornament of swamps and sloughs, benefactor of man, the lustrous redwing ought to sing, undisturbed, his "O-ka-lee."

The adult male in spring is a lustrous velvet black, burnished with a metallic greenish reflection. On the bend or shoulder of each wing is a patch of vermillion red ,and just behind this, a tinge of brownish yellow. The red and buff at the bends of the wings, are the only markings that relieve the otherwise uniform black of the male.

The female resembles a large sparrow. Her plumage is of harsh texture streaked, top of head dark brown, with buffy median crown stripe; nape and fore part of back, dark brown, lightly marked with buffy; shoulders faintly tinged with red; under parts whitish, heavily streaked with dark brown; throat tinged with creamy, buff or pinkish. Length, 8.10-9.30.

THE WESTERN MEADOW LARK.

"Now hear the lark, the herald of the morn."—*Romeo and Juliet.*

As one rambles through grassy lanes and over western fields, there springs up from his path no bird more beloved than the song-filled Western meadow lark, that little God-send to the farmer. As widely distributed as he is beneficial, he gives attractiveness to the fields of Indian Territory, Western Kansas, Nebraska, North and South Dakota and to all that territory between these states and the

Pacific; also in Alberta, Southern British Columbia, Southwestern Saskatchewan, and Western Manitoba.

The **nest** is usually beside a tuft of grass; and it consists of coarse grasses or weed stalks, lined with finer material of the same kind. The whole is neatly domed and so well hidden that one often flushes the mother bird before detecting her nest. The eggs, usually five in number, are white, spotted and speckled with brown-purple and lavender.

The meadow lark is one of our most common birds, and its song lends enchantment to almost every grassy lane. Sometimes it sings with liquid clearness a series of notes which seem to say, "This town is a pretty place;" and at others pours forth measures of greater complication and richness. Matthews says that its minstrelsy reminds him of the first two bars of Alfred's song in La Traviata; at any rate the half dozen songs of the Western Meadow Lark are clear and sweet, far more thrilling than that of the Eastern variety. Our lark seems to delight in caroling his rapturous melody from some fence post, though he spends most of his time hunting insects and weed-seeds on the ground. The meadow lark is the most useful bird that flies about the fields. It eats michief-making bugs and pernicious seeds, seldom varying its diet by devouring the forbidden. A table made from data furnished by the Biological Survey shows clearly the great aid the meadow lark is to Western farmers. **The food** of the bird for the year is as follows:

MONTHS	Stomachs Examined	Animal Food Per Cent	Grain Per Cent	Weed Seeds Per Cent	Total Per Cent
January	13	24.36	75.28	.36	100
February	1	.00	25.00	75.00	100
March	12	73.14	17.00	9.86	100
April	28	77.51	15.10	7.39	100
May	8	97.99	1.88	.13	100
June	20	95.79	2.10	2.11	100
July	18	97.32	.00	2.68	100
August	28	99.35	.00	.65	100
September	29	99.20	.40	.40	100
October	40	94.39	.61	5.00	100
November	22	77.08	6.50	16.42	100
December	19	39.22	32.70	28.08	100
Year	238	72.95	14.71	12.34	100

We see that nearly three fourths of the meadow lark's food consists of insects, over twelve per cent is weed seed, and less than fifteen per cent is grain. We notice that during the months of July and August, harvest time, it does not touch grain; therefore we conclude that what grain it does eat is gleaned from the fields, when the coldness of winter has driven insects away. When wheat is yellow in the fields, ninety nine per cent of the meadow lark's food consists of animal life, mostly noxious insects.

Of the **Orthoptera,** the meadow lark eats red-legged grasshoppers; grasshoppers make up one fourth of its yearly sustenance. Of the **Coleoptera,** or beetles, it feeds on weevils, billugs, curculios, clover weevils, fireflies, lady birds, snout beetles, leaf-eating beetles, fleas, rove beetles, moths, cut worms, and army worms; the two last are particurarly destructive. Of the **Hemiptera,** or true bugs the meadow lark feeds upon stilt bugs, soldier bugs, spittle insects, assassin bugs, tree hoppers, jumping plant lice, and chinch bugs. It has been estimated, that during the last half century chinch bugs alone have destroyed grain in the United States to the value of $300,000,000. The meadow lark eats ants, wasps, stinging ants of the order **Hymenoptera,** and devours ticks, small snails, thousand legs, sow bugs, and spiders.

In the winter months it gleans from the fields some wheat, clover seed, corn and oats; but it is only because insects are scarce that it resorts to grain. It feeds upon the seeds of pigeon grass, panic grass, smart weed, ragweed, black mustard and bayberry. The meadow lark is **protected by law** in all the Western states except Idaho and Missouri; but despite this fact it is shot for food. Unlike the Eastern lark, which flies with an occasional jerk of the wings, and then sails a short distance, the Western bird flies with a continuous flutter. Both varieties are easily killed on the wing. The charming companion of the roadside, the tireless benefactor of man, the Western Meadow Lark should everywhere meet our greatest respect and protection.

Special Characteristics.—Back, dark brown with rusty and grayish intermixtures; rump and tail feathers, barred with blackish brown stripes; secondaries, tertiaries, greater and lesser wing coverts, barred with blackish brown and rusty. On the jugulum a V-shaped black patch strongly contrasts with the yellow about it; under surface, bright yellow and gray. Bill, long, straight, pointed, light blue below, black above and at the tip. Length of bird tip to tip, 10 inches; tail, 3.25; bill, 1.25.

THE RED-SHAFTED FLICKER.

A chill autumn breeze was shivering the remnants of summer foliage from the skeletonized orchard trees; but listen! the lusty crackle of the hearth cannot account for that drumming sound—it is a red-shafted flicker lingering still in the woods, and sure enough, there he is, a splendid bird, walking upward and around a grubby, old apple tree, pattering and pecking with the energy of a miner's drill.

To most people here, the word "woodpecker" recalls the very bird we are considering. He is of considerable size when compared with other birds of the orchard, his total length being slightly over a foot. Years ago, a flicker was accustomed to beat such a loud tattoo on the schoolhouse that our teacher frequently permitted us boys to go down and frighten him away. He would alight upon the building and clatter at his hole while all about were noisy children at recess. If the bird in some localities appears to be shy, it is very likely because Indians and boys hunt it for its delicate colored feathers. **His song** is varied and strong. Sometimes he utters a "quap! quap! quap!" in low tone, but most frequently during the day he gives vent to a harsh "ker-ip, ker-ip." In the springtime, his call consists of "took! took! took! took!" resembling the call of a hen.

The nest of this bird may be found from two to seventy feet above the ground. It consists of a cavity chisled out of a dead stub or live tree trunk to a depth of one or two feet. Apple orchards seem to be prefered, but occasionally one may find a nest hole in a post, a telegraph pole, or even an embankment. The holes made in the houses are usually for winter homes, not for nesting purposes. There is no lining or down in the nest, the bits of wood pecked from the tree forming a sufficiently soft bed for the little ones.

With surprising sagacity, they discover a hollow limb or trunk under a perfectly sound bark; then, alternating, they proceed to peck at the hole for days until the task is done. The male and female are, at times, affectionate; and especially at the nest building time, do they encourage each other with every possible action and note of endearment. Sometimes they become so occupied in their work that one may hear them tapping late into the night. The nest-boring usually takes place between the first and fifteenth of May; and from four to ten white glossy eggs are deposited by the first of June.

Two broods are raised in a year. If a nest of fledglings is disturbed, the parents fly about, uttering shrill notes. The young, hiss like cats. When the birds have flown the parents occasionally fill up the opening to the nest; but, usually, a new hole is bored each year, for no matter how hard the wood, the flicker seems able to make the tiny chips fly with his strong bill.

Food.—Fifty-six per cent of the flicker's yearly diet is made up of ants—a fact as astonishing as it is gratifying. Ants are small, but their destructive power is enormous. Not only are they wood borers, but they perpetuate lice or aphids. Millions of dollars worth of vegetation is lost through the aphid each year!

The flicker also destroys beetles, moths and miscellaneous insects to the extent of about twenty per cent of his annual fare. Only one per cent of its food consists of grain and a similar amount is of fruit!—a fact which alone shows the flicker to be one of our most useful birds. Of the mite of fruit taken, a large part is made up of raspberries, and blackberries, usually wild. Besides these, it eats hackberry, poison ivy, sumac, elder, and Virginia creeper. Of the weed seeds it destroys thistle, amaranth, acorn and wild grass. What a shame ever to destroy a bird marked thus by beauty, usefulness and power!

The red-shafted flicker, has upper surface, black and brown; under surface, orange red, white and black; wing quill shafts, orange red, almost coral. Back, and lesser wings, light brown, each feather barred with black. Rump, white; upper tail coverts marked with alternate stripes of white and black. Closed tail, forked and black; open tail, orange, red basal shafts on the outer four quills, but terminals black. Back of neck and throat, ash; black crescent on breast; abdomen mottled. Male has red cheek patch; absent in female. Tongue round, barbed, and long as a man's finger. Length about one foot. It lives from Mexico to Canada, and from the Rocky Mountains to the Pacific coast.

Part II. Spring Studies.

a. Flowers and Crops.

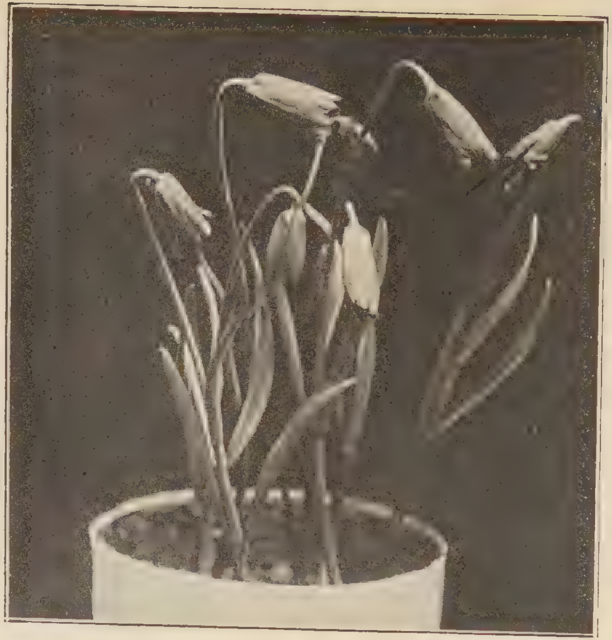
TWO YELLOW LILIES.

In March or April throughout the Rocky mountains, certain Western lilies may be found in all their beauty. They gleam from the hillside shrubbery like flashes of gold. From out of their leaves of satiny-green velvet the golden flowers flash in rustic frames of gray, formed by the oak bark. The flowers rise above a carpet of browns made of the oak leaves, which make the fertile black mold. Only in this rich soil can these delicate plants thrive.

These yellow Western lilies are said to be the nearest like those on the hills of Palestine, concerning which the Savior said: "Consider the lilies, how they grow; they toil not, neither do they spin; and yet I say unto you that Solomon in all his glory was not arrayed like one of these."

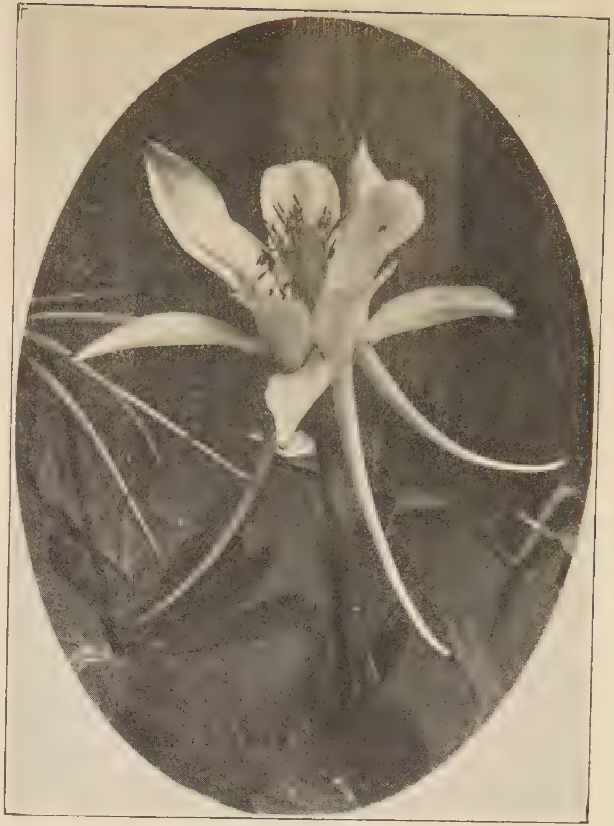
> "They neither toil nor spin, but careless grow,
> Yet see how warm they blush, how bright they glow!
> What regal vestments can with them compare!
> What king so shining! or what queen so fair!"
>
> —Thompson.

Two Glorious Flowers.—Shall we go out with the hill climbers and bring down a bouquet of these beautiful lilies? One of them bears the strange name of dog's-tooth violet; the other is called, and much more properly, a snowdrop. The first bears its absurd name in the East, but is a true lily and no violet; the second is a close relative of the true snowdrop, resembling it in everything but color. The difference is that in the snowdrop family, the lower portion of the flower cup (the perianth) is united with the pistil, or ovary, which is therefore said to be inferior; while in the lily family, to which our snowdrop belongs, the perianth and stamens are free from the ovary, and arise from its base. In the yellow "snowdrop," the petals form a close, rather narrow, bell; in the dog-tooth violet, the petals are reflexed and curl backward, each forming a little bower with its long, tapering, coiled "tooth," or "adder's tongue," as this



FRITILLARIA—The Rice Root.

The Modest Fritillaria, or Snowdrop. Colorado's State Flower, the Rocky Mountain Columbine, at right. Both life size.



one is sometimes called. Erythronium grandiflorum is the botanical name of the one with the long, separate, recurved petals of pure glistening yellow. "Grandiflorum" signifies the grand or showy flower. Fritillaria pudica is the name of the cup-shaped, reddish-yellow flower called the snowdrop. "Pudica" means modest, and refers to the bowed head of the dainty cup-blossom. It has still another name, the yellow rice-root, in allusion to the rice-like cluster of young bulbs that form at the base of the three-fold corm at the root in preparation for next year's plants. This name was given to the drooping, yellow-bell-flower many years ago by Menan's Magazine. Both of these pretty flowers may be called yellow lilies, since that is what they are. They happen to be the best kind of flowers to begin studying. They are beautiful of form and color, simple of structure, fragrant, easily found, and very abundant. The lower grades in the public schools and beginners generally should study these regal and delicate beauties.

In Erythronium, the stem bears near the base a pair of flat, dilated, net-veined, opposite leaves. The flowers are showy, an inch long, bright yellow, the petals tapering to a point, and recurved. In Fritillaria the stems are erect, simple, leafy, from three to eight inches high, and one to six-flowered; the flowers are nodding, yellow or orange, and tinged with purple. Both grow well in cultivation.

THE SEGO LILY.

Western Indians had been treated with fairness by the Rocky Mountain pioneers. When, therefore, some of the first settlers were destitute of common comforts and short of food, the red men told them of the sego and other plants that they used as food. The white people were thus saved from actual famine. In pioneer days, during early spring, the people of Utah used to dig the bulbs of the sego, Calochortus nuttallii, as a choice article of food. Not more than twenty years ago, sego digging was still a favorite pastime of boys and girls. The writer has often engaged in it, and in those days found the sego a sufficient substitute for sweetmeats. The finding and digging of the bulbs gave zest to sego harvesting, and whetted the appetite for these morsels. Those who wish to taste the nutritious bulb of the lily that has earned its place in the history of a Western commonwealth, will find that the bulb of this delicate lily is at its best as a dainty morsel in early spring. The plant grows on every sagebrush hill. It may be known from its slender, grass-like stem and leaves, resembling at this season a bluish wire-grass, about six inches high, and at first consisting of only two leaves. It may finally grow to twelve inches, but always bears only a few, usually three, linear leaves, which clasp the stem at the base. The lower leaves are alternate, but later there is an upper, small, opposite pair. From these arise two main branches, each bearing a flower. Occasionally there are three or four flowers, or only one.

The Silvery Lily.—The flowers usually appear about the beginning of summer. When fully expanded, they are bell-shaped, symmetrical in outline, and are white, striped with mottled green and tinged with purple on the outside. Within, the color is pearly white, marked with purple above and yellow below in a large bearded and spongy spot near the base. The flower measures about an inch and a half each way. The three petals are heart-shaped, tapering, sharp-pointed, and finally spreading outwards. The heart, the lance, the bow, the arrow—Cupid's paraphernalia—all appear in its makeup. It grows in fertile soil, being partial to sagebrush benches.

Parts of the Sego.—The bud from which the flower expands is cone-shaped and tapering, and finally becomes nearly an inch long. Its sepals, or outer flower leaves, have the edges very slightly overlapping; but the petals, the inside flower leaves, are rolled about each other in the bud. These six flower-leaves form the perianth, or flower divisions; opposite each segment, or flower-leaf, is a stamen with a blunt, arrow-like anther. The pistil is three-celled, narrowly oblong, and several to many seeded. It is a question whether or not the sego is reproduced from seeds, or whether it arises always from the little bulbs that form at the roots after the flowering is over. On account of its rare and delicate beauty, its fragrance, and the entire absence from this choice species of any aspect of weediness, it seems a pity that it has rarely been domesticated. It is literally all flower, and has no weed-like remainder after blooming. To grow it the bulbs must be dug. The thread-like stem, white and glistening beneath its papery underground coat, goes into the soil about six inches or more, and there expands into a tender scaly bulb, which is sweet and nutritious before the plant flowers, but after flowering is dry and tasteless. This bulb is usually about three-fourths of an inch long and less than half an inch wide. It grows at the base of the two very fine, bluish-green, terete (rounded) leaves; is the size of a sparrow's egg, and just before flowering is sweet and juicy. But no one should eat the sego bulb for the first time unless accompanied by some one who knows it.

Beware of the Poison One.—There is another lily, the poison sego, with a similar, but larger bulb, and with numbers of deep-green, out-curving leaves, folded lenghwise with a deep groove, and hence said to be equitant or two-ranked. The two sego plants are very dissimilar, but have been confounded with serious and even fatal results. The writer for a time doubted the accuracy of reported cases of poisoning from eating bulbs of the poison sego. To test the matter, he sent some of the bulbs to a botanist in Brooklyn for analysis. Dr. Eccles had the bulb analyzed, and found in one large specimen enough albumenoid poison to kill a grown man. A few years ago, one of the plowmen at the University, observing the children of the training school picking up and eating the lily bulbs he had plowed up, ate some himself. He must have eaten also a poison bulb, for he was taken violently ill with stomach trouble and a physician had to work hard to bring him through. Thus there is an edible sego bulb, the Calochortus, and a poisonous one, the Zygadenus. Both are called segos—the name being derived, probably, from the Indians, and hence pronounced "see-go," and not "say-go." The latter is the name of a food plant of commerce, from which sago pudding is made. To call this flower a "say-go" instead of a "see-go" is a needless confusion of plants entirely different. Besides, the Indian name sounds better, being more apt and characteristic, and if retained will preserve its Indian origin.

Like the flower-cup of the common tulip, which appears to have six petals, though three of them are really sepals, so Calochortus has its three sepals so petal-like that it seems to have no calyx. The three outer leaves are somewhat green on the outside, and are smaller than the inner ones (the petals). There are thus two sets of floral envelopes forming the sego flower, and each is petal-like within. Mr. Douglas first discovered this genus in the year 1831, in California, and named it from the Greek "kalos," pretty, and "chortus," grass; so that its name signifies "pretty grass," in allusion to its grass-like stems surmounted by flowers of great beauty. Calochortus luteus, the yellow species, was therefore named by the Royal Horticultural Society the Yellow Pretty Grass; it flowered in their gardens at Chiswick near London. In Colorado, the sego is called the Mariposa lily. The editor of the London Garden wrote, in 1876: "We have so long considered Mariposa lilies somewhat delicate and fragile that we are agreeably surprised at finding them keep for a considerable time in water, and freely open their large, gay, yet delicately marked blooms." Gold, silver, and purple, the royal colors, are beautifully combined in the dainty bell of the sego lily, which is truly a thing of beauty and ought to become in Western gardens, a joy forever.

ARROW-LEAVED BALSAM ROOT.

UTAH STATE FLOWER—THE SEGO LILY.

There are three balsam roots. The one shown here (Balsamorrhiza sagittata) has flowers about 3 inches across, bright golden with yellow centers, leaves often 6 inches or more in length, silvery with fine hairs, arrow-shaped, on long stems that rise from a common center. The great root goes down, carrot-like, several feet into the ground, and is filled with balsam of the stickiest sort that would probably make good India rubber. If so, the West is fortunate; for these plants grow plentifully on dry hillsides, the rain of winter being sufficient for them. Their great leaves soon dry away, but the root remains. Their culture would thus present no problem. Two other species have divided, fern-like leaves, similarly large and showy.

THE POISON SEGO.

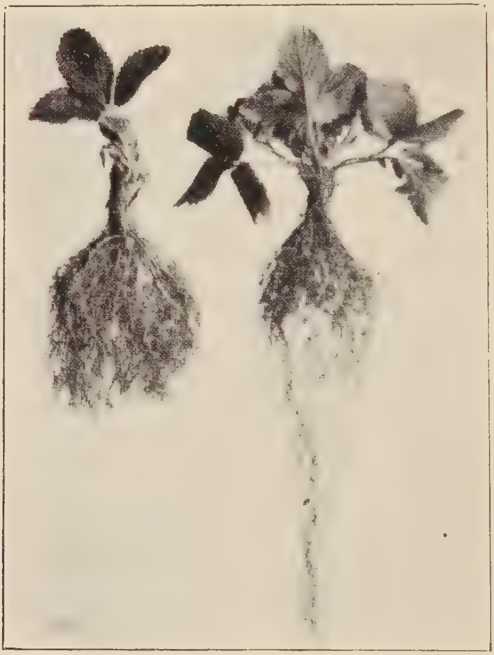
A study of Zygadenus has been made by pupils of the third grade in the state normal training school. They took a lesson on the wild onion, then on the poison sego, as follows. They discovered: (1) that its most striking feature is a fountain of sickle-shaped, folded, shining green leaves; (2) that the main stem, a foot high, bears a long, narrow cluster (panicle) of greenish white flowers and a few half-clasping, half-papery leaves; (3) that the anthers give a yellowish color to the flowers; (4) that the flower leaves, the calyx and corolla, are six-parted, star-shaped, and spreading, the divisions broadly egg-shaped (ovate); (5) that the stamens are six in number, the anthers two-celled, opening lengthwise to shed their yellow pollen, and fixed by the center on slender stalks (filaments) so that they "teeter" up and down; (6) that the styles are three, thin and awl-shaped; (7) that the pistil, or fruit pod, is definitely three-united, and many seeded, the seeds small; (8) that the lower flowers are in groups of from six to twelve on short stalks (pedicels); the upper, single on larger stalks (peduncles); (9) that the leaves are folded (equitant) and parallel veined; (10) that the flower stalk is a round, brittle, filled cylinder; (11) that the lowest leaves arise from scales which form an underground, upright stem; (12) that this stem ends below in a coarse, scaly, onion-like bulb, one and a half inches thick and two inches long, covered with black layers on the inside, but pearly white within, and very poisonous if eaten; (incidents of poisoning were related here); (13) that the true roots beneath the bulb are fibrous; (14) that the plant is a lily, its flower being in threes, with leaves imitating those of the blue flag, and a bulb imitating that of the sweet and edible sego lily; (15) that the leaves are sparingly eaten by cattle and sheep, which are sometimes poisoned thereby.

The scaly bulb of the poison sego is black outside, and when full grown is an inch and a half thick and two inches long. A dense fibrous root system springs from below the bulb. The flowers are small and form a mass or spike cluster of greenish white flowers, the six yellow anthers giving to the flowers their yellowish cast. Both the sego lily and its poisonous relative belong to the family of lilies, but are of different genera. They grow side by side, the sego lily prefering the rich soil and shaggy shelter of the sagebrush, while Zygadenus prefers the open. They are like types of good and evil, of beauty and beast, of virtue and vice, flourishing in the same environment, and thriving under the same conditions. Each has an original nature of its own, fixed by the seed; and the same environment does not seem to have much effect in making the two alike. Heredity is more potent than environment in causing each plant to be what it is.

STRAWBERRIES.

Strawberries grow wild in the mountains, but the berries are small. Cultivation increases the size and quality of the fruit. This crop is the most important of the small fruits. But the average yield is only 1,456 quarts per acre. This crop could be doubled without increasing the acreage. But the best varieties must be selected and the methods of culture improved.

Soil and Site.—Strawberries will grow in many kinds of soil, but require plenty of moisture; light or sandy soil, deep and mellow, suits them best. Such soils cultivate easily and bring an early crop because they are warm. Heavy or clay soils need much well rotted manure before use in berry growing. Different varieties need different kinds of soil, but only those plants should be chosen that are cosmopolitan—that do well in almost all places. Retention of soil moisture and proper irrigation are the most important factors for success. Bench or high land is best, so deep that it holds water long after irrigation; so sandy or gravelly that the water goes into it and does not lie in pools; so rich with humus or barn-yard manure that it can be worked easily after every rain or irrigation. For very early crops northward or in high valleys, south slopes are chosen. The southern exposure and sandy soil hasten the ripening by several days or a week. A northern slope retards ripening, but prolongs the season and may be preferred in warmer or lower valleys. Berries take up much water. The soil must be kept moist, but not wet; must be well supplied with humus or barn manure; or alfalfa or clover must be plowed under. Humus soils hold the most water and contain also the most plant food. Manure increases the chemical activity and the bacterial life of the soil—the processes that aid the plants. Deep plowing is necessary, and prior fall plowing is useful. Deep spading and thorough raking in small, hand-worked beds is essential. Deep plowing and plenty of harrowing must be given on larger tracts. The soil on top must always be kept well broken and fine. It should never be allowed to bake or become lumpy. By working or plowing deeply, the soil will draw up the moisture by what is called capillary action, as a cloth dipped into water will do if it is fine but not if it is coarsely woven. A fine layer, called the dust mulch, kept on top of the soil in dry weather, prevents evaporation and the plants do not wilt.



The strawberry plant at the left, as it is dug from the nursery. The same plant at the right pruned for transplanting. All but three of the leaves are removed and the roots are trimmed as shown. Trimming before transplanting is a general practice, but is not so often applied to the roots as to the tops of trees and shrubs.

Planting and Care.—Early spring planting is preferred, though fall planting succeeds in places, if rightly done. Plants should be pruned before setting in the bed. If not, the extra leaves will wilt from lack of moisture. A deep trench is dug, or deep holes made, for each row. Roots should be pruned, if they are more than four or five inches long. Water is taken in by the roots and is given off through the leaves. Plants drink and transpire. Roots newly transplanted absorb water slowly, but the loss of water through the leaves continues to be quite rapid. Removing all but two leaves is good practice. Set the plants so that the crown above the short stem is just level with the top of the ground. If set too deep, the terminal bud will be injured. If set too shallow, the roots near the surface will dry out. Cover the roots and all but bury the crown. Press the earth firmly about the roots, irrigate well, and mulch the wet surface with a little sand. Do not expose the roots to wind or sun. Replant quickly. Frequent and shallow tillage, with hoe and rake, to keep a dust mulch on the surface is one secret of success. Cultivate as soon as the surface is dry, after every rain or irrigation. A baked soil cracks and lets the moisture evaporate. Tillage keeps in the moisture, liberates plant food, and keeps down weeds. Stir the soil very close to young plants. Cultivate further away as runners appear. In the small garden, set the plants in hills, cultivate both ways, and do not let the runners fill in. Large growers in the East set wide rows and let them fill in with runners about six inches apart. Runners are cut by hand or by a rolling cutter attached to the cultivator; their blossoms are cut off to increase growth. The plants will bear the next year.

The Winter Mulch.—In early winter, to protect against alternate thawing and freezing, a mulch of two or three inches of some rather fine material, such as clean stray or marsh hay should be applied to the patch. In large areas, the manure spreader is most economical in applying this mulch. It is best to leave the mulch undisturbed during a frosty spring to retard blooming and thus avoid frost injury. As growth proceeds, the straw can be raised in places where it is too heavy for the plants to push through. The mulch should be left on during the fruiting season. It conserves the moisture and smothers most of the weeds. The few that come through should be promptly pulled. It is almost impossible to cultivate during the fruiting season and have berries free from grit. With the mulch, clean attractive berries can be produced.

The strawberry blossom at the left has only the mass of little seed flowers in the blossom. At the right, B has seed and stamen flowers. The left is the pistillate or female flower; B. is the staminate blossom.

B

The Flower.—Strawberries belong to the rose family. The flowers have 5 sepals, 5 petals, many stamens, and many pistils. The picture A shows a center resembling a button. It is covered with green points—the pistils—forming the berry. If it succeeds, it must receive pollen from the flower with stamens, shown at B. The pollen makes the berries grow; without it the pistils wither and die. The stamens surrounding the pistil are erect whitish filaments. They bear on their ends yellow, knob-like organs called anthers. The anthers bear a fine yellow dust known as pollen. When a pollen grain falls on a pistil it germinates, and sends a slender tube-like growth into the ovule. This is called fertilization. The wind and insects transfer the pollen from one flower to another. Observe that the flower pictured at A is devoid of stamens, but bears pistils. It is therefore known as a pistillate, or, imperfect, or female flower. A flower of this kind must be fertilized by pollen from such a flower as is shown at B, which has both pistils and stamens. The latter is therefore known as a staminate, or perfect or male flower. It would bear fruit of itself; but many of the best late berries are from imperfect or pistillate flowers. These are very prolific if interspersed, about every third row, with a staminate or perfect flower that blooms just a little earlier, and so has the pollen grains ready just when the pistils of the others are ready for pollination.

THE POTATO.

Origin.—The potato is a native of the valleys of Chili, Peru, and Mexico. The wild potatoes of these regions differ from the cultivated form in that they produce seed balls more freely. Tobacco, tomato, and egg-plant, all belong to the potato family. Potatoes were introduced into Virginia during the latter part of the sixteenth century. They had become a common article of diet among the colonists and Indians along the Atlantic coast as early as 1722. In Europe, with the exception of Ireland, potato growing made little progress until the middle of the eighteenth century. The potato is an annual. It has smooth, solid, more or less square, herbaceous stems. The leaves are compound and are composed of oval leaflets. The flowers are borne in clusters. Each has a five-pointed corolla and varies in color from white to purple. The tuber is an underground stem, and the eyes are the leaf buds, like buds on the branch of a tree. The potato tuber is a colony of individuals; the eye is the unit, or single part.

Size.—Potatoes do best on light soils, which should be well prepared before planting the crop. They require a deep, loose seed bed. The roots must penetrate freely, and the tubers need room to form and expand; hard lumps and baked soil cause trouble. About four inches is the depth to plant potatoes. The time to cut potatoes into seed pieces is just before planting. Half a potato will usually give a better and more profitable yield than either a whole potato or smaller pieces. The potato should be cut in two lengthwise. Large seed usually insures a finer yield than small seed. This larger crop may be due to the greater amount of nourishment furnished by the large seed to the young plants. The large seed enables them to make stronger growth. Large tubers seem to possess more vigor than small tubers. Yet whether we should always use large or small seed, cut or whole, may depend upon the cost of seed, the season, and the culture that can be given. As a rule tubers that weigh two or three ounces make the best seed. Here are some points that determine the value of a variety of potatoes: (1) good cooking quality and flavor; (2) the yield; (3) ability to resist diseases; (4) the color of the skin and tuber; (5) the shape; (6) the depth and the number of the eyes.

Kind.—Americans prefer a mealy potato. This mealy quality is due to the union of the starch grains in a cell into one mass, and to the rupture of the cell walls during cooking. Potatoes that have been irrigated a great deal are usually of inferior quality to those sparingly watered. Quality depends also upon the temperature—the hot or the cool weather during which the tuber has been grown. Potatoes buried deep enough in the soil have grown in an even temperature and are always better than those grown near the surface. For near the top of the ground the temperature has varied, with the hot days and the cool nights. Potatoes with white or pinkish skin and white flesh, slightly flattened, and round or oval, are the best sellers. Shallow-eyed potatoes are better than deep-eyed ones. For the Rocky Mountains some good varieties are: Early Rose, Early Ohio, Peerless, Early Bangor, Burbank, Rural New Yorker, Carman No. 3, and Eureka.

Care.—Potatoes are usually planted in rows about 30 inches apart, the hills 12 inches apart in the row. Small gardens may be planted by hand; large fields, with a planter. The size of the piece planted determines whether we should cultivate with hoe or with horse. Cultivation is profitable not so much to kill weeds as to increase the yield. Cultivation increases the yield: (1) by liberating plant food; (2) by maintaining good texture; (3) by keeping in the soil moisture; (4) by keeping weeds in check. Potatoes may be cultivated either in hills or level. The hill system is used in irrigation; but the furrowing often injures the roots and reduces the yield.

About a week after planting, the spike tooth harrow should be run over the field. This creates a loose top layer of fine soil—an effective mulch—and destroys all young weeds. The first two cultivations may be about four inches deep. After that only shallow cultivations should be given, because the potato roots, as a general rule, lie close to the surface of the ground. Potato scab is due to a fungus that lives upon the potato. This disease may be prevented by soaking seed potatoes for two hours in a solution made by using one pound of formalin to 30 gallons of water. Lime, wood ashes, and barn-yard manure aid the growth of scab, while any acid fertilizer injures its development. Scab can live in the soil six years without any known plant to live upon. In the end, it must draw its support from living upon some plant called the host.

Profit.—The Department of Agriculture states that of all the factors in potato growing, selection of seed is the most important. An experimenter undertook to improve and develop a potato along the same lines that he follows in improving his sheep and cattle, using the best method of selection and giving the seed plat the best possible cultivation and irrigation. He selects seed potatoes of the size and type which he desires to produce. As a 12-ounce potato is about ideal in size, seed potatoes of that size were selected from the bin in the spring and then 4 or 5 acres were planted in a special plat for seed, to be used for the main crop the following year. This plan was followed for twelve years with a potato (the perfect peach-blow) which, it was said, would degenerate and ultimately run out; but that potato continued to improve during all that time.

"There is no line of farming in the irrigated districts that gives such marvelous profits as that of scientific potato production. With scientific knowledge, which can be acquired by experiments in supplying perfectly balanced plant food and maintaining soil fertility, and with the proper proportions of plant foods—phosphates, nitrogen, and potash—in the soil as found in many parts of the West and by the use of clover and alfalfa, there is no reason for those who contemplate engaging in the potato industry to fear the outcome."

GROWING NATIVE FLOWERS.

"There, scattered oft, the earliest of the year,
By hands unseen are showers of violets found;
The red breast loves to build and warble there,
And little footsteps lightly print the ground."—Gray.

Decorating the Graves.—On Decoration day, thousands will deck with flowers the graves of the departed. Wild flowers will be plucked in untold quantites and strewn upon the mounds—truly a beautiful custom, but it threatens the extermination, near the cities, of many of our most beautiful wild species. Now, it happens that there are a number of native flowers that can be successfully grown in the cemeteries. Those mentioned here are all in bloom on Decoration day. The wealth of boquets to be strewn upon the graves of our dead is often a waste of thousands of blossoms of wild species, plucked off to wither in a day. On the other hand, many of the native flowers are of surpassing beauty, and are known to be of the easiest cultivation.

The Sego Lily.—The Utah state flower, may be named first, on account of its rare and delicate beauty. Calochortus nuttallii has only a few leaves, and these are so slender and grass-like that the specimen is literally all flower. In digging the young plants, we find that the bulbs are very small at first. They have no doubt been formed from the bulbs of the previous year, since they grow deep in the ground—from four to eight inches. The bulbs are renewed from the old root. This plant, once started on a grave, will usually flower by Decoration day or shortly afterward, and will bloom through early summer. It leaves no weed-like vegetation, but practically disappears soon after the period of its bloom. The sego is scarcely exceeded in beauty by any American flower. The bulbs, which are very small considering the size of the flower produced, may be dug in late summer or early fall, and after left out of the ground for a short period, planted again. They should have a sandy soil, and in very cold countries protection should be given. They are easy to raise from the bulbs, but not from the seed.

Green Cammas (Cammassia), the bulb of which is largely collected for food by the Indians, is a rather large and usually deep-blue lily on a stout stem (scape) a foot or two high.

Wild Hyacinth (Brodiaea) is a lily with long, deep-blue or purple tube-like corollas; leaves few, basal, grass-like, often a foot long, the scape or flower stem, sometimes 2 feet high. It grows in rich, moist soil in the canyons. These are not hardy species.

The Hedysarum.—The most ornamental of legumes is a species related to the sweet pea. It is a handsome, bush-like plant that sometimes grows several feet in height and diameter, bearing a profusion of red-purple pea-blossoms toward the end of May. It is of a different genus from the sweet peas, of which, also, we have several ornamental varieties of easy culture. The former is distributed over the hills in occasional bunches, and has been successfully grown from seed. It is quite as beautiful as the well known bleeding heart of the gardens, and of somewhat similar aspect; but it is larger and darker, its slipper-shaped flowers of a deeper purple. It has no common name. Its blood-red petals might entitle it to some designation that should typify the blood that has been shed in defense of the nation, and thus render it peculiarly appropriate for decorating the graves of the soldier dead . The books call it Hedysarum pabulare.

Forget-Me-Nots.—We have several pretty forget-me-not species that grow wild in great profusion. The showiest of these, Echinospermum floribundum, is a branching annual that bears long lines of pretty white flowers dotted with blue. It thrives everywhere and blooms in May. It would probably grow well from seeds and would make an ornamental appearance over the grave at Decoration time. After it blooms, it should be cleared away, since its seeds ripen into small, pricky burs.

The Balsam Root.—Among the composites, Balsamorrhiza sagittata, is a splendid sunflower-like species. It is a perennial, without a stem, abundant of bloom in early spring. It developes large, silvery, unique, arrow-shaped leaves, which form a clump as if arising from a flower pot. It should be grown from seed to be gathered in early summer. It is a sort of wonder plant, its great tap-root filled with a white, sticky juice that ought to make good Indian rubber. It would be an ornament in any garden. Another species usually smaller, has silvery, divided, fern-like leaves, and is likewise a plant of great beauty.

Other Native Beauties.—The ragged Astragalus utahensis, which is exclusively native, is another beautiful specimen. Children call it the pink lady-finger. It forms a silvery mat bearing pretty pale-purple flowers, and would cover the grave all summer with a

THE HILLSIDE EVENING PRIMROSE.

(Oenethera marginata) most suitable Western plant for low garden border. Flowers large, white to pinkish, borne, beyond the long 4-sided pod; stamens 8, with anthers swinging; style 4-lobed. A fragrant, early flower of spring, of easiest culture, and of great beauty.

most artistic carpet of delicate hue and charming pattern. It is a member of the pea family. Then there is the carmine gilia, or wild "honey-suckle," as the children call it—a tall and stately plant bearing a long raceme of carmine-red clusters of trumpet-shaped flowers that fairy flash and glitter in the sunlight. Its foliage has a strong, pungent, and somewhat disagreeable odor. It is named Gilia aggregata. Two beautiful evening primroses, Oenethera, marginata and albicaulis, with their large, fragrant, and lily-like blooms, are earlier, and as dainty and fragrant as the finest of the cultivated species in any garden. The larger-flowered primrose, is known to be of easy culture and may be grown from seeds. It makes a most beautiful border, and flowers all summer under cultivation. Many have grown it with success. This is certainly one of the most likely of the wild plants for domestication. Other species somewhat less ornamental, but still very fine, are the wild sweet william, the larkspur, the scarlet mallow, the wall flower, the large splendid geraniums white and red, the Oregon grape, and the wild hyacinth.

The Astragalus, or Lady Finger.—Walk out over the hills and look for spreading mats of a silvery gray plant, often a foot or more in diameter. In spring it has bunches of pink flowers of irregular tube shape, about an inch long. In the fall it bears numerous, short, curved, very woolly pods. The leaflets somewhat similar to those of the sweet pea; or you may find a smooth, shining green plant, with mottled green pods, but otherwise similar to the first-named. This is the green astragalus (A. iodanthus).

Wild Sweet William (Phlox longifolia) has several pretty pink flowers on each stem. They fade to white under the sun. The style in all the pink family is 3-parted, the pod 3-celled, 5 united petals and 5 united sepals. The stamens are of unequal length, so that flies, as they wind their way to the bottom of the tube get covered with pollen. Stems rough, straight, and covered with fine hair, to endure heat and to retain moisture. Leaves linear, mostly opposite. A pretty flower easily cultivated. Hood's phlox has awl-shaped leaves and single white flowers; it forms a dense tuft on the ground.

Gilias have mostly alternate leaves. The buff-flowered gilia (G. grandiflora) blooms only at the unbranched summit of stems ½ to 2 feet high, corollas like narrow funnels, pale salmon color. Jacob's ladder (Polemonium) has alternate pinnate leaves, foliage often sticky and ill-smelling. Flowers blue in one species, white in another; both with bright yellow anthers.

Indian Paint Brushes (castelleja) have top leaves and calyx red or white, the corolla pale and not showy. They are allied to Pentstemons.

Scarlet Mallow (Malvastrum coccineum) is a low, mealy-grayish herb with 3 to 5-parted leaves, and brick-red flowers resembling small hollyhocks—a mass of yellow stamens and a flat wheel of seeds. It grows in dry soil and waste places; it is of easy culture and great beauty.

The Columbine.—Finest of all stands our beautiful white form of the Rocky Mountain Columbine (Aquilegia coerulea albiflora—Gray.) In Colorado and elsewhere in the mountains, this species produces blue flowers; but in the high canyons, the white form predominates. Yet in places many beautiful variations occur, so that the discriminating collector has the opportunity, if the plants are dug when in flower, of obtaining a variety of color. "This species has reached a point in its development where it is ready to make a 'break;' that is, it will, under cultivation in different environments, undergo variations in the color, size, and shape of the flowers. English and Continental catalogues now list many varieties of it, obtained by raising the plants from seeds gathered in our mountains. In my own garden I have raised many striking forms from seeds gathered at Brighton."—Johnson.

Aquilegia flavescens is the yellow, short-spurred columbine. It is found at lower elevations than the white, and in more damp and moist places; in fact, generally in running water. The flowers are not showy, but it has a very long period of bloom, and readily thrives in the garden.

Monkshood.—(Acontium columbianum), is generally found assciated with the yellow columbine. Its beautiful blue-hooded flowers are conspicuous along the streams in our canyons. It is easily grown, and the roots may be dug at any season.

Thalictrum fendleri, or false maidenhair fern, has inconspicuous flowers, but the delicacy of its foliage entitles it to a choice place. It is frequently mistaken for maidenhair fern. It is easily raised and may be readily grown from seed.

Flowers of Palmer's Pentstemon at left. Blue Pentstemon (P. cyananthus) at right. Often called bluebell, but is a beard-tongue, resembling the fox-glove. These splendid flowers are of easy culture and should be grown in Western flower gardens and public parks.

In the photograph of Palmer, we are looking into the front (the throat) of the flower, and do not see the long tube of the corolla.

The Beardstongues.—In the celebrated Pentstemon genus we are met with a bewildering array of beauty and variety. Pentstemons are notably characteristic of the Plateau; of the sixty-four species mentioned in Gray's Synoptic Flora over one-half can be found, and there are a few species that have not yet been named. No other genus presents finer variety of color, form, and size. Of easy growth, they have long, tough, fibrous roots, so that they may be safely transplanted, or they may be successfully raised from seeds. Nearly every color and shade except yellow is represented. Pentstemon cyananthus has brilliant blue flowers in a close, compact spike, which open pretty evenly over the spike at one time. It is found in nearly every part of the mountains. Pentstemon eatoni, commonly called "wild honeysuckle," is brilliant scarlet, with tubular, scarcely bilabiate flowers, thriving at its best in Provo canyon. Pentstemon utahensis is somewhat similar to Pentstemon cyananthus, but with larger flowers, growing in profusion in high parks. Pentstemon azureus produces lavender-colored flowers, and occurs in many of our canyons. Pentstemon parryi, from Southern Utah, is brilliant pink in color, low growing, and most charming. The queen of all Pentstemons is palmeri with its large, sweet-scented flowers, giving forth the oder of the peach blossom. It is white, striped with rose, producing a delicate pinkish effect. Its home is far southward, and, unfortunately, it is the least hardy of the group; though, with slight protection, it survives the coldest winters northward. Many other species abound within the mountains and on the deserts.

These beautiful blue flowers called locally blue bells are the representatives of the fox-glove of the Old World. Our best species grow a foot or two in height, and bear a mass of corollas each about an inch long, of varying shades of blue, clustering from six to twelve inches along the top of the main stem. This mass of blue color arising above and extending from the leaves, which are of a shiny, green aspect, gives to these species a regal and stately appearance decidedly attractive. Our early blue bell is profuse in flowering and comes into bloom before the end of May.

Erythronium grandiflorum, or dog-tooth violet, is one of our earliest and loveliest flowers. The bulb grows six or eight inches beneath the surface, and is hard to dig but is worth the effort. It should be given a very cool and moist place. Other bulbous plants worthy of attention are, the wild onion, whose showy pink flowers give an attractive display; the poison sego, and Claytonia, the spring beauty.

Geraniums may be recognized by their regular 5-parted flowers, 10 stamens, and 5 styles, which separate when ripe. Storksbill is a geranium; but there are two splendid species in the mountains and river valleys, both strong, bushy perennials. Fremont's geranium has large, lobed, rather thick leaves on long stems, cleft into 3 to 5 segments, those from the root 7-cleft; flowers pink-purple with darker veins. Richardson's has rather thin, 3-5 parted leaves and white flowers. Both of these beautiful flowers are easy to rear in gardens.

Blue Flax may be known from its perfect, regular, symmetrical flowers, all its parts in fives, the blue petals falling off daily. The stems are erect and smooth, 1 to 3 feet high, densely covered with numerous, very narrow leaves. Long fibers run through the bark, from which linen is made; a larger flax is cultivated for the linen of commerce, and several kinds with yellow petals grow in the mountains. Flax is easily grown; the seed-pods in winter are very interesting.

Cowslip, or shooting star, has yellow stamens and purple anthers contrasting with the rose-colored petals at the top of a simple stalk, the leaves all at the base, forming a rosette. It grows in wet soil.

Wild Pea (Vicia) and vetch (Lathyrus) are trailing or twining pea-vines with deep green pinnate leaves usually tipped with a curling tendril, and showy, purple blossoms with banner, wings, and keel, with protect the stigma till the bee, dusty with pollen from other pea flowers, probes the blossom for honey, and the sticky stigma licks up the pollen dust from the bee's hairy coat, in order to fertilize its seeds.

Clarkia, a tall evening primrose with brittle, leafly stem, has showy, deep-purple or red-violet petals of rhomboid form, arising from the top of the calyx tube, which, an inch in length, grows from the top of the ovary. This rich-colored and stately "fireweed" outranks most garden flowers, and may be grown in rich, moist soil in the shade.

River Hollyhock (Spheralcea rivularis) is a large, beautiful mallow, 2 to 6 feet high, with flowers like those of the garden hollyhock, about 1 to 1½ inches across in long loose clusters on the top stems, pink, white, or pale lavender. It has stout stems 2 to 6 feet high, and grows along banks of mountain streams. Ripe carpels are prickly.

"Not much preparation need be made for gathering the plants. On my trips I take a strong steel trowel or a digging fork. A piece of wet rag, a pocket handkerchief, some newspapers, and pieces of string, complete the outfit. In digging, one should be careful to wrap the roots immediately in a wet rag, and thus prevent exposure to the air. They should be replanted at the earliest opportunity, after first having been left standing in cold water for an hour. Most of the foliage should be stripped off, and, of course, all the flowers. The plants should be shaded from the direct rays of the sun for a few days until they have recuperated. The best time for planting wild flower seeds is early in the fall, shortly after the seed has ripened. The seedlings will have attained considerable size before the cold weather sets in."—Ben Johnson, Salt Lake.

b. Net-Winged Insect Allies.

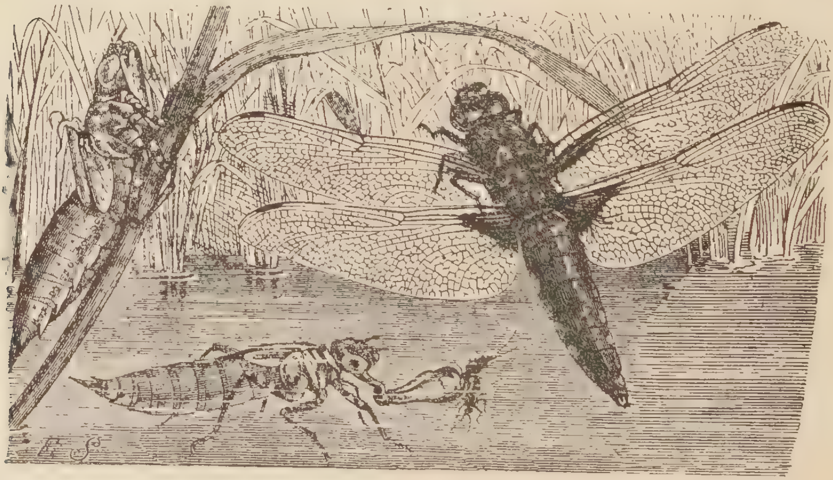
MOSQUITO HAWKS, OR DRAGON FLIES.

Our Friends.—The chief enemies of farm crops are insects. Animals that destroy insects are therefore friends of the farm. Some of the chief insect destroyers are large-sized insects called dragon flies and smaller ones called damsel flies. The picture shows what they are like, and most people have often noticed them. Dragon flies rest with their wings outspread—at right angles to their bodies; damsel fiies hold the wings folded along their backs when at rest. Both kinds may be of various colors or black or grayish; but damsel flies are more often of delicate green, blue, and other fine hues. Some damsel flies are golden or red in color, and all of them are more graceful and delicate than their big cousins the dragon flies. French writers call them damoiselles. Children often call the larger dragon flies darning needles. None of these insects should ever be harmed or molested. They are among our best friends in the insect world. Their life's work consists in aiding us to destroy insects, and they rid us of untold numbers of them.

Kinds.—There are said to be 300 kinds of dragon flies and their smaller cousins, the damsel flies, in the United States. There are said to be 2,000 species over the earth. They are most numerous in moist countries, where ponds and rivers abound, so that, in the arid interior, there are fewer kinds than in the Eeastern states, while coast regions have very many. But they do not like salt water, and their young do not mature if the water is very brackish or if it contains sulphur. The adults dislike cold weather, and do not fly on very cool days. Neither are they numerous at high altitudes. The adults are said to live only from about 25 to 45 days, yet in warm regions they are found throughout the year. The adults feed on flying insects, which they catch with their arm-like fore-legs and devour with their strong jaws.

Habits.—They fly like hawks in pursuit of their prey, darting swiftly over ponds and streams or through the woods not far from water. Each one seems to have its own hunting area in the air, from which it chases other dragon flies that may intrude. Needham says that the smaller damsel flies keep very close to the water, rarely venturing more than an inch above the surface. Larger ones fly a little higher, those with amber wings at an average of six inches. The larger skimmers are a foot or more from the surface, while the upland skimmers and darters fly still higher. The damsel flies stay close to the water in order to escape being eaten by the dragon flies, which dart in the higher air above them. The dragon flies are strong fliers, nearly always on the wing. They catch their prey while flying, eat it while flying, and some of them deposit their eggs while on the wing. They often alight to rest, and the damsel flies are at rest most of the time. They are the swiftest and straightest fliers of the insect world.

Structure.—They have four strong wings and a long, smooth, cylindrical, or tapering body, which offers little resistance to the air in flight and serves as a rudder to steer and change quickly the swift



DRAGON FLY.
Adult on wing, pupa on stem, larva in water catching mosquito wrigglers with extensile lip.

course of the insect. All four wings are long, rather narrow and very much alike. They have many net veins to give them strength, and the front margin of each wing is strengthened by double veins and a sort of tied knot or node in the center. The large, compound eyes of the dragon fly make up two-thirds of the bulk of the head. Each of these large eyes, if studied under a lens, is found to consist of an enormous number—30,000 single eyes, each capable of seeing a small object directly in front of it. The surfaces of the small eyes, called facets, are directed from all sides except the rear, and so the dragon fly can see in three directions without turning his head. Since the head works on a joint and can be turned half way round in each direction, the principal part of each eye can be directed sideways or straight up and down. Those with the largest eyes have also the swiftest flight. Like the grasshopper, the dragon fly has three simple eyes in the front of its head. A large upper lip hangs over the mouth like a curtain. The jaws are strong and have teeth for tearing and crushing the captured prey. All the legs point forward, making a sort of leg basket in which to catch and hold the prey.

Usefulness.—Almost any kind of flying insect is seized and eaten but mosquitoes and flies are the usual victims. The ravenous appetite of these insects has excited the wonder of all observers. They will eat each other if their regular prey fails. They are among the most useful of insects, but no means of specially multiplying their numbers have yet been devised. In Honolulu the mosquitoes are a fearful plague at night, but are not noticed in the day time, probably because the dragon flies are so numerous there. These mosquito hawks may be seen after their prey even in the principal streets. Were it not for these vigilant destroyers, life in many tropical islands would be intolerable.

The larvae of the dragon fly are as useful as the adults. They live in water from the time they hatch from the tiny eggs until they emerge from their last shell as dragon flies. Thus they pass through only three stages—the tiny eggs, like small pearls, laid on weeds or on the water surface, then the ugly little creature that comes out of the egg, called by some scientific wag a nymph. The nymph grows and sheds its skin four or five times. When full-grown, it climbs out of the water, sheds its last skin, and appears as the adult, with shining wings, to live in the air.

Control of mosquitoes.—Since mosquitoes carry diseases from one person to another in the tropics—malaria, yellow-fever and elephantiasis—the work of dragon-flies in destroying these pests is of the greatest benefit. Mosquitoes breed rapidly, and dragon flies, when numerous, keep them in check. Dragon flies lay their eggs on wet mud or attach them to moist plants near the water surface. Damsel flies and a few of the dragon-flies lay their eggs in plant stems just below the water surface or on moss-covered rocks or wood below the water. The eggs of some species hatch in from six to ten days, others in about a month, and others, laid in the fall, do not hatch till the following spring. The larvae (nymphs) that come from the eggs of damsel flies are very small—1-25 to 1-12 of an inch long—with slender bodies, long spider-like legs, and a pair of leaf-like gills at the end of the body for breathing in the water. They have no sign of wings, but are like the adults in feeding on other insects. At first they attack only very small creatures, but by the time the nymphs are full grown they are ready to seize almost anything in the water, and have been known to devour young brook trout as long as themselves. All the nymphs have a long, grasping lower lip which is thrust out quickly to seize their prey, but is folded over their face when not in use. Their jaws (mandibles) are strong and sharp.

The true dragon fly nymphs do not have long, protruding gills for breathing. They breathe by taking in water at the rear of the abdomen; then they eject the water in spurts, and this action propels them forward. The nymphs, like the adults, are said to have certain regions in the pond for their own use. Some dig holes and keep the water muddy, where they lie concealed, ready to catch every unwary insect that comes near. They feed freely on "wrigglers," which are the larva of mosquitoes. The nymph grows rapidly because it eats so much, and soon gets too large for its skin, which will not stretch far but splits open. The nymph crawls out, clothed with a new light-greenish or blueish skin, which soon darkens to a brown or slate color. They cast their skins (or moult) several times until full grown. Then they crawl out of the water, and their leather-like skin splits along the back for the last time. The adult slowly works its way out of the case. At first the wings are damp and limp, the body soft, and the colors pale, new, and shiny. In the air the wings soon expand, the colors deepen, and the insect takes flight through the air in pursuit of its insect prey, chiefly gnats and flies. The writer has noticed that a late, moist, cool spring seems unfavorable to the development of dragon flies, and favorable to mosquitoes, which, unchecked by their natural enemies, then abound in unusual numbers to our discomfort.

LADY LACE-WING AND HER LITTLE CANNIBALS.

Stranger than a fairy story is the truth about the lace-wing. "Lady Lace-wing" is a four-winged fly, with shining red or garnet eyes. Her wings are netted. I often catch them in my screened porch, and study with a lens their filmy wings and lustrous eyes. After you learn about this pretty insect and her hungry children, you can tell their story. This is how one student told it:

A REAL FAIRY.

I have read of fairies and other things
  That fly through the clouds and skies;
But a fairy I know that has lace-like wings
  And beautiful golden eyes.

On the leaves this fairy builds small, thin wires,
  Puts a ball at each tip for a crown;
And out of the egg-balls, along these spires,
  Hungry aphid-lions crawl down.

For this fairy's children are lions fierce
  With terrible tong-like jaws;
And green bugs perish in teeth that pierce;
  Nor to rest will these lions pause.

They slaughter the lice on each leaf and rose,
  Crush the aphids that feed on the corn;
And only stop if a cold wind blows,
  When they creep under leaves to keep warm.

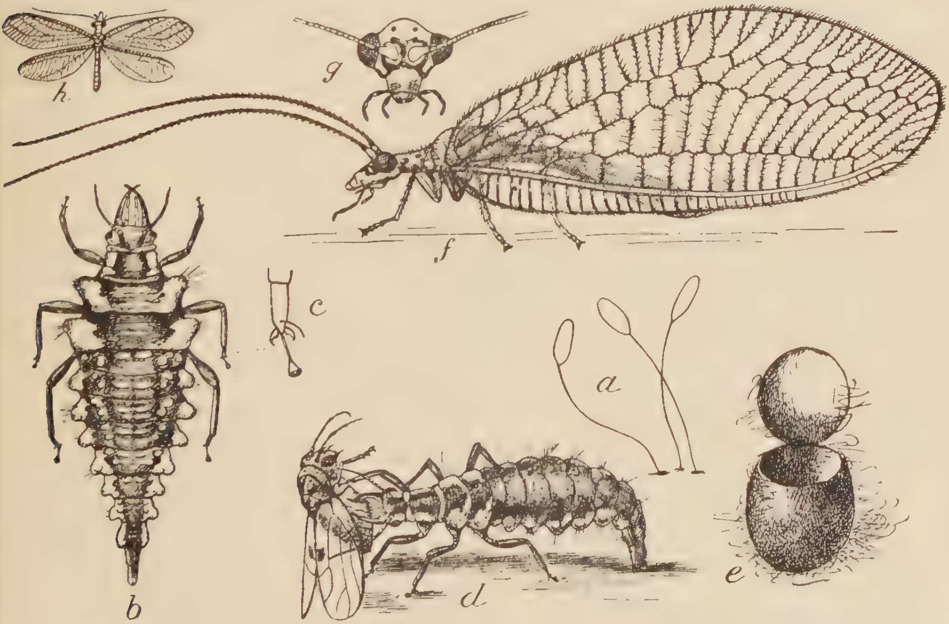
But at last when each has eaten his fill,
  He stops killing and steals away;
Winds himself in silks that keep him still
  For more than a week and a day.

Then forth he comes, a creature new—
  Little pads on his back for wings—
Sheds his skin once more, and full into view
  A golden-eyed lace-wing springs.

Where corolla-bells ring, in odors, their tunes,
  Where honey-dews glint 'mid the flowers,
Lady Lace-Wing gleams, as the sweet perfumes
  Overflow apple-blossom's deep bowers.

The lace-wing fly resembles a film of finest green gauze drifting on the breeze. Her color is pale greenish. Each wing is a little over half an inch long. The feelers—the two little horns that arch out from the head—are as long as the wings. The wings have a fine network, like a cobweb leaf. Among leaves she resembles a thin leaf. But the golden eyes, round and shining like little garnets, show what she is, and you try to capture the pretty creature. As you pick her up, she exhales a disagreeable odor, and you are willing to let her go. This odor protects her from enemies. The lace-wing seeks out some bush or tree covered with plant-lice. A drop of sticky fluid comes from the tip of her body and touches the leaf; she lifts her abdomen and the fluid lengthens into a fine thread that is stiff enough to stand alone. On the top of this little pole she lays an egg the size of a pin point. She keeps on till she has reared a small grove of these tiny flag poles with knobs on the ends. A leaf so covered looks silvery. The eggs become dark after a few days, and with a lens we can see a spindle-shaped creature with a pair of tongs for jaws. The tongs cut through the shell and the little creature wriggles out. He clutches the flag pole with his six legs, and at last crawls down to the leaf surface. If any plant lice are there, he opens his jaws and seizes one after another. The tongs are hollow, and he drinks the green blood of the plant lice through them. He holds each one up in his jaws to drink it dry, then casts it aside for another. If another aphis lion meets him where there are no plant lice to eat, one lion will eat the other. They are cannibals. The mother lace-wing seems to know this, and that is why she lays each egg on the top of the white rod. For the first lion to hatch out would eat the others as fast as they crawled from the shell. But though they can crawl down the little pole, they cannot climb it. Each one takes about ten minutes to creep down, and so has time to get busy killing plant lice before another lion comes along. The aphis lions begin to hatch in July, and are found all summer and fall till cold weather comes. The lace-wing's eggs may be easily found on the leaves of various plants. The leaves can be brought into the school room and kept fresh. Then the actions of the young lions can be observed, and they can be supplied with plant-lice till they get their growth. Then they will double up and spin small, shining, pearly cocoons about themselves, and fasten them to the leaf. After a week or two a neat round hole is cut in the cocoon and a little green pupa comes out. It is lively, but has no wings, only wing pads. After the pupa sheds its skin the insect comes out as the beautiful golden-eye, with pale green wings. It is strange that the lace-wing should know just how to lay her eggs, so that her hungry children will not devour each other. These insects serve us well. They destroy whole colonies of plant lice. The young aphid lions are called larvæ. Since they feed on other insects, they are good friends of ours.

The picture shows at a the eggs, each at the tip of a long stiff thread and always in the vicinity of plant-lice, which are the chief food of the larvæ. In clover fields the lace-wing's eggs are common on leaves or stems, and the larvæ eat ravenously the clover louse and other aphids, and eat one another now and then,—particularly when a lot of them issue at the same time from one cluster of eggs. The prey is seized between the points of the long, tapering mandibles of the asphis-lion and the blood is sucked back through a channel made by a groove along the inner face of the mandible. A newly-born larva soon selects for its first meal a small tender aphid; "under the microscope, one can see the watery juices of the victim bubbling along the transparent jaws of the captor." These larvæ are



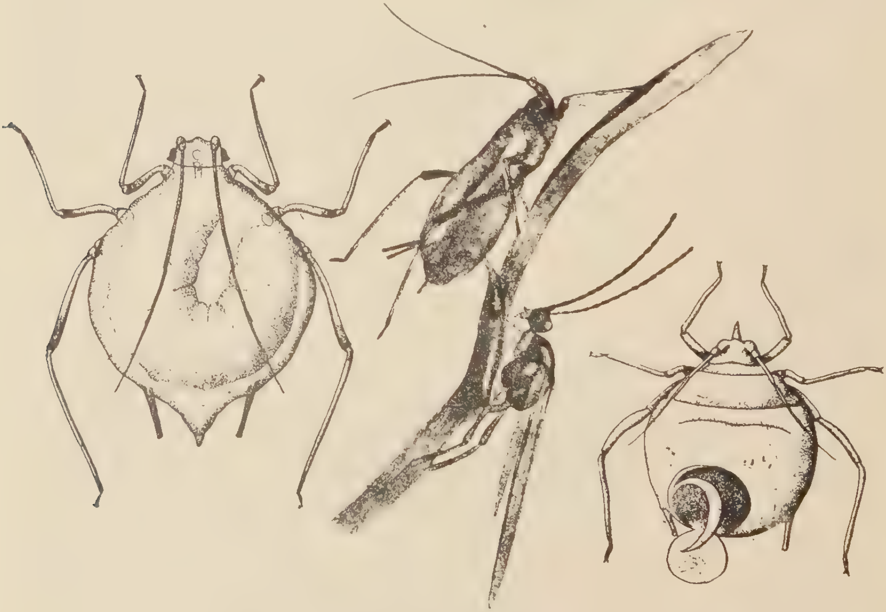
Lace-wing Fly, *Chrysopa oculata*: *a*, eggs; *b*, larva; *c*, foot of same; *d*, larva devouring pear-tree Psylla; *e*, cocoon; *f*. adult; *g*, head of same; *h*, adult, natural size (Chittenden, Circ. 43, Bur. Ent., U. S. Dept. of Agriculture.)

THE LACE-WINGED FLY.

active creatures, gray, yellowish, or brownish in color, though colorless at birth. They grow rapidly, and in one to three weeks spin a silken cocoon. The cocoon, spherical or oval, shows, after the adult comes out, a circular lid.

Mr. Folsom of the Illinois station found a kind of tree cricket devouring aphids on red clover, taking about one louse per minute.

Other Aphid Killers.—We have seen that the golden-eye has four wings. There are certain small two-winged insects called syrphid flies, common in clover fields, that are similarly useful. Many of these flies are banded with black and yellow, and have the habit of poising here and there above clover leaves, and flying swiftly from one place to another. The flies lay their eggs in or near colonies of plant lice, on which the larvæ are to feed. The larvæ resemble small green, yellow, or brownish leeches. They attack and destroy the clover lice at a rapid rate. "The syrphid larva seizes an aphid between its hook-like jaws, holds it aloft, and sucks the blood from its body, meanwhile waving itself to and fro." The pear-shaped body below the larva is the form into which the larva transforms before changing into the adult fly. Syrphids are often called flower



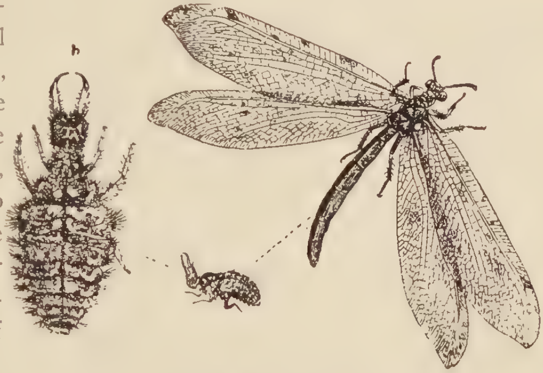
Lysiphlebus, sp. attacking grain plant louse. From life.

HOW THE PARASITE DESTROYS APHIDS.

flies; they somewhat resemble small bees; but bees have four wings.

Fortunately for us, still other insects destroy the aphids; certain small, two-winged and four-winged insects lay their eggs in the bodies of aphids. The eggs placed in the body of the louse hatches in a few days and the larva feeds on the tissues of its host. Soon it gets large enough to be seen in the body and the aphid dies. Then the larva changes into a fly, cuts a round hole in the wall of the dead aphid, and escapes. Our cold winters prevent the increase of aphids and our warm summers favor the increase of these parasites before the lice have become numerous.

The Ant Lion.—The larva is shown at its beginning and at its final stage. The larva grows, the winged insect (the adult) does not. Notice the finely netted wings, showing relationship to the dragon fly; the wings have no knot or node, on the front margin, which those of the dragon fly always have.



THE ANT LION.

Certain other insects have net-veined wings somewhat similar to those of dragon flies. They are considered relatives of those larger "mosquito hawks;" all are grouped together under the name of nerve-winged insects. "Nerve-wing" means fine veined, while the coarser veins of the dragon fly's wings receive the name "net veined." Most of the nerve-winged are useful and very interesting. One of them is called the ant-lion. The adult is a large, gauzy-winged insect, expanding 2 1-2 inches, with a long slender body like that of the damsel fly. Unlike the wings of dragon flies, the wings of ant-lions have no joints at the center of the front edge, but are spotted with brownish or black. The adult ant lion does not kill ants, but simply lays its eggs in the sand. These hatch into small but fierce and hungry creatures that live on other insects. Hence they are "carnivorous larvae." These are the ant lions. They have strong jaws and rounded bodies. Each digs for himself a little pit in the loose sand, and hides himself at the bottom, with only the strong jaws projecting; a busy ant hurries along and stumbles over the edge into the pit in the sand. The loose sand gives way, as the ant struggles to get out, and it slides to the bottom. In a moment the vicious jaws close on this unfortunate ant trapped in this "horrible pit." There are a number of insects related to the ant lion. Some of them hide under stones and wait for their prey to come within reach of their long, sickle-like jaws. Their adults have long feelers, or antennae, with knots at the end like those of butterflies. They are found in trees and lay their eggs there. Other kinds have bent necks and are found in pine, spruce, and cedar trees. These have been called "snake flies" and "rubber necks." Their larvae have been seen feeding on the apple worm, the larva of the codling moth. Another family of them have long forelegs similar to the mantids and use these legs for the same purpose of catching their prey alive.

All these are somewhat related to the nerve-winged insect common in all orchards and celebrated for its great usefulness and beauty —the golden-eyed fly, or lace wing, previously described.

c. Some Useful Beetles.

Every one knows something about the "little people in armor"— those insects with hard wing cases (elytra) that cover and protect their bodies like shields. The "lions and tigers" of the insect world are well represented among these armored tribes. Many of them wage constant war on other insects, and are thus the friends of man. Beetles are among the best known and most popular of insects.

Fire Flies are beetles—a kind not common in dry countries. In wet regions, and especially in the tropics, the ground at night often scintillates with their flashings and with those of the larva—the glow worm. In giving out this light no energy seems to be consumed, and a dozen of them together may create enough illumination for slow photography. Several segments of the abdomen give off this light, the nature of which is wholly unknown, though some scientists are working at the problem. A firefly held in the hand at night lights up the palm, but creates no heat; it is a cold fire.

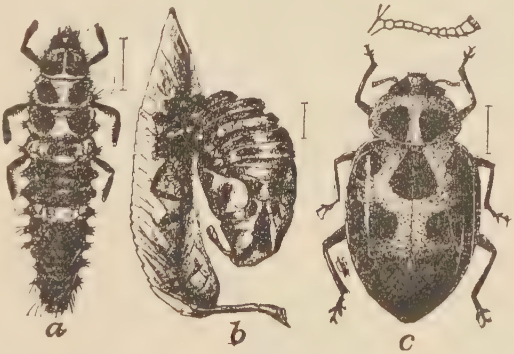
Does the creature illumine some fairy insect ball room or reception hall? It is a fairy condemned to wear an ugly shape all day, but allowed to become beautiful at night?

"Like a glow worm golden, in a drop of dew,
Scattering unbeholden its aerial hue,
Among the flowers and grass, which screen it from the view."
—Shelley.

LADY BIRDS, OR LADY BEETLES.

Lady bird, lady bird, fly away home;
Your house is on fire, your children alone.

Did you ever say a rhyme like that? The lady bird is a small beetle. Most lady beetles are red or yellow with black spots. They are half-round, their backs look like small red balls cut in two. Each is like half a pill. It is good that children never injure them, but let them fly away home, for they are very useful. Nearly all kinds of lady beetles feed on other insects and not on plants. Hence they help to save the plants from being eaten by insects. The baby lady-beetle, which is called the larva, does most of this good work.



—Ladybird. *Megilla maculata*: *a*, larva; *b*, empty pupal skin; *c*, beetle. (Chittenden, Circ. 43, Bur. Ent., U. S. Dept. of Agriculture.)

a. The spotted lady-bird larva, which destroys plant lice. The small lines show the natural size; b. is the empty skin of the pupa, from which the lady beetle (c) finally emerges. It is fastened to a leaf. Notice that both the larva and the beetle have six legs. They are true insects. Compare with the spider, which has eight legs, and is therefore not an insect.

There are said to be 150 kinds of lady beetles in the United States alone. Nearly all of them are small and reddish brown with black spots; or they are black with reddish spots on their wing covers. They are easily seen because of their bright colors yet it has often been noticed that the insect eating birds do not take lady-birds.

These beetles must be ill-tasting to the birds. Their bright colors, too, may warn or frighten the birds.

Lady birds lay their eggs on bark stems or leaves. They choose those plants which are infested by plant-lice (aphids) or by scale insects. Often they lay their eggs right in the middle of a colony of plant lice. They do this because their young, or larvae, feed on the aphids. Their larvae are ugly, broad-shouldered, rough, spiny, active little beasts, usually marked with black, red, or brown. They have strong jaws and feed steadily on the soft-bodied aphids and scale lice. They also eat the eggs or young of other larger insects. When full grown, they shed their tight fitting coat for the last time and come out.

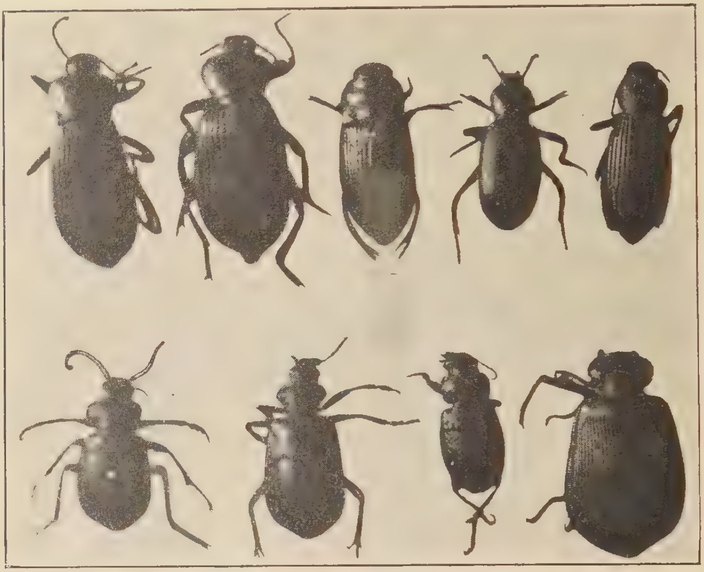
The two-spotted lady bird is reddish yellow with a single black spot on each wing. The nine-spotted has yellowish wings, with four black spots on each and a spot that reaches both wings just behind the thorax. There is another called the twice-stabbed lady beetle; it has a bright red spot on each wing covert. There is a 15-spotted lady-bird, a large species with seven black spots on each wing and a common spot back of the thorax.

Beetles in Sunlight.—Other beetles display their full glory of color only in the sunlight. Observe that Coleoptera, the name of the order, signifies hard or bony shells—a mark that characterizes this group. Beetles may be known by these hard wing covers which meet in a straight line down the back. Beneath these wing covers, called the elytra, there are usually found a pair of softer wings. Many of these wing covers have beautiful and brilliant hues, the late summer milkweed beetles, for instance, being of an iridescent blue or green. Many of them shine with metallic luster. Others are covered with the golden dust. Still orders are striped with bars and curious patterns. In fact, every color in nature has been lavished upon one or the other of these lowly creatures. The color is not merely laid on, either; it is even more than inlaid, for every hair grows its color from within. The list of beetles seems to have no end, and we mention only a few of the larger ones. These shiny creatures of the ground are divided into two large groups—the genuine and the snout beetles. The latter have a long beak, inside of which the jaws work. The ordinary beetles have biting mouth parts, and the jaws work sidewise, as with other biting insects.

Tiger Beetles are swift-running, long legged, agile beetles that can both run and fly. They are likely to abound on bright, hot days by road-sides or streams. Many of them are marked with stripes, whence their name. As you come near them they fly a short distance. "Before alighting," says Comstock, "they always turn so as to face the person approaching." If captured, they may be fed on raw meat. Though the adults live entirely above ground in the open, the larvae of the tiger species dig in hard, beaten ground, vertical burrows that are often a foot in depth and about one-sixth of an inch in diameter. Here the larva rests while watching for its prey; its dirt-colored head, bent at right angles to its body neatly plugs up the hole. "Its rapacious jaws extend forward, wide open, ready to seize the first unwary insect that walks over this living trap. On the fifth segment of the abdomen there is a hump and on this hump are two hooks curved forward. This is an arrangement by which the little rascal can hold back and keep from being jerked out of its hole when it gets some large insect by the leg, and by which it can drag its struggling prey into its hole, where it may eat it at leisure."

ROCKY MOUNTAIN TIGER BEETLES.
The long legs, folded under the body, do not show well in the picture.
From pupils' collection. Harwood's photograph.

True Ground Beetles are those whose larvae never live in holes in the ground, but run about to capture their prey. All these larvae are black in color and are very active. Adults often have long grooves or round, hollow dots on the wing covers. Most beetles that keep upon the ground are useful. Many are black in color and large in size. They eat almost anything, and can easly be fed in cages. The adults have ravenous appetites and are cannibalistic in habit. That is, they eat their own species when other prey is scarce. One of the most noted of them is the fiery ground beetle, a shiny green, iridescent species about two-thirds of an inch long, brought to America to aid in the war on the gypsy moth of the New England states. This insect destroys from 25 to 30 caterpillars in a day. Some 20,000 of them have been brought into Massachuetts. Not only

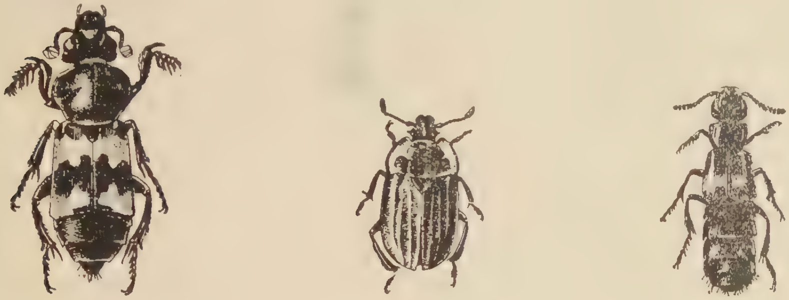


COMMON WESTERN GROUND BEETLES.
From pupils' collection. Harwood's photograph.

do they destroy the caterpillar, but they capture and eat the female moth also, thus preventing the egg laying. We have several similar kinds (Calosoma) in the West.

OTHER USEFUL LAND BEETLES.

Burying Beetles.—Some of the scavenger group are known as burying beetles. The species that have the habit of burying small dead animals are of two groups. The members of one of the groups that do this live entirely above ground and do not purposely bury the animal. They will simply creep under any dead animal, say a bird, to lay their eggs in it, and may partially bury the carcass in so doing. But others purposely cover up with soil the bodies of small dead animals which they find lying on the ground. Dead mice, gophers, prairie dogs, and even rabbits are speedily disposed of; and as these beetles are found almost everywhere, they are a most valuable group. They excavate beneath small dead animals, gradually sinking them below the surface level. In both types the larvae are black and flattened. The carrion group perform a service especially important in temperate regions, but not so great in arid tropical countries, where dead animals quickly dry up and are less of a menace to health than in cooler climates. These beetles have clavate or clubbed feelers. The antennae terminate in little knobs. We find them on any decaying animal matter, which they promptly proceed to eat or to bury. They do this for their own purpose; they lay their eggs in the carrion, so that the larvae may live on it. In all their life stages, they feed on decaying animal matter, and are therefore always useful. They have the sense of smell strongly developed, and are largely nocturnal in habits. Their activity in burying the food for their future larvae is truly wonderful.



BURYING BEETLE. CARRION BEETLE. ROVE BEETLE.

(Each enlarged one and one-half times.)

Rove Beetles are slender species of similar habits and usefulness. They are travelers, or rovers. Their antennae resemble a string of fine beads. The wing shields cover only half of the body. They are carrion feeders and consume the decaying flesh of animals left on the ground.

They may often be seen about small dead animals. Many of them have brown or red marks across their bodies. Some of them are found in decaying fungi.

USEFUL WATER BEETLES.

Predaceous Diving Beetles.—We have several good insect friends that live in the water. One group is called the carnivorous water beetles, or diving beetles, since they dive as well as swim. They live on other insects and are therefore said to be predaceous. There are many kinds (300 species) of these beetles in America. They are found wherever streams and ponds abound. Some are large (as the Dyticus species), about 1 1-2 inches long. But others, in the same group, are less than 1-5 of an inch long. All of them may be known by their boat-like bodies. The smallest ones can be distinguished from the small whirligig beetles because the divers have but one pair of eyes. The whirligigs, of which there are some 40 kinds, have the compound eye on each side divided into an upper and lower part. The larvae of the diving beetles are slender, six-legged creatures known as **water tigers.** They have large, flat heads and long, sharp, curved hollow jaws. With these they seize an insect and drink its blood. Both the larvae and the adults are fierce and voracious, sometimes attacking small fish. In the middle States they thus do damage in fish ponds. The larvae finally come out of the water and make cells in the earth. They remain there as pupae all winter, and then come out as adult beetles.

WATER SCAVENGER BEETLE

(Natural size.)

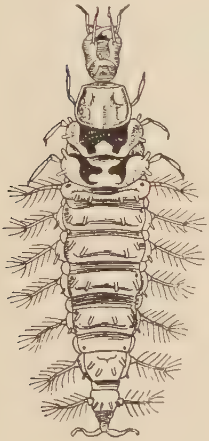
WHIRLIGIG BEETLE

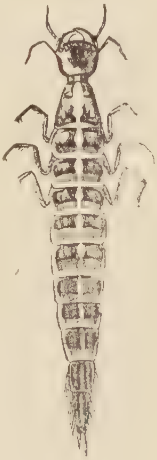
(Twice natural size.)

PREDACEOUS WATER BEETLE

(Natural size.)

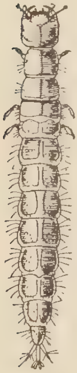
Scavenger Beetles, found in the same pools with the predaceous diving beetles and whirligigs, are distinguished from these two groups by the short, club-shaped, almost concealed antennae. In the scavengers, the slender mouth feelers, (the palpi) project like antennae. Scavenger beetles feed mostly on decaying matter, and so are useful by preventing the poisoning of the water. The sides of the body beneath the wing, are covered with fine hairs. This covering they use as an air sac, or air reservoir. When they come to the surface, these spaces between the fine hairs fill with air. Then they close their wings and dive again into the water. Then the entire under-sides of the body are seen to be covered with a shining silvery film. This is air. which they breathe into the air tubes as long as it lasts, and then they come to the surface and open their wings for a fresh supply. They lay their eggs in a ball-like, silken cocoon, which has a curious, curved handle, and floats on the water. The larvae are long, but stouter than the water tigers. They also feed on insects, and breathe through openings (spiracles) at the tip of the bodies. The adults can fly; in winter, they burrow in the mud. In the spring they come out and live in the water, or fly about in the air. The diving beetles are found in company with the water-scavenger beetles, which have clubbed antennae, while the divers have slender thread-like feelers. All the diving beetles are oval in form and flat-convex on top. They have hard, smooth, shiny wing-covers and brownish or black, smooth bodies. Their boat-like shapes enable them to swim well. When at rest, they hang head downward from the surface of the water, as if they were suspended from a ceiling. In this position the tip of the abdomen is protruded out of the water, for breathing; for, like other insects, they breathe through open tubes (spiracles) on the abdomen. The females often have the wing covers furrowed lengthwise. The hind legs are long, strong, and flattened like oars, for swimming. They turn their legs as they swim, just as an oarsman turns the paddle. Though they dive and stay long under the water, they come to the surface to breathe.

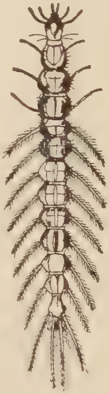




Water Scavenger and Water Tiger.—At the left the larva, natural size, of the great water-scavenger beetle. The larva feeds on living insects, snails, tadpoles, etc. At the right the water-tiger—the larva of the predaceous water beetle. Observe the long, curved mandibles, for sucking the blood of the insects and small water animals which this voracious larva feeds upon.

Whirligig Beetles.—Predaceous diving beetles have only two eyes. Whirligigs have four eyes, two, above and two below, because of a division of the eyes. They are much smaller than the predaceous kind and are recognized by their curious spin-ing or circling in groups on the surface of ponds or still pools. There are many kinds—about 40 species in North America. They vary in size from 1-4 to 3-4 of an inch long. All are of similar rounded shape and of a blue black color. Like the large water beetles, they dive freely and carry down air on their bodies for breathing when beneath the water. They carry the air bubble at the tip of the body. The hind legs are broad, paddle-shaped, and fringed with long, stiff hairs. These little water beetles can fly; but usually climb on some weed or stick to make the start. They can also sing in squeaking tones by rubbing the wings against the end of the body. This noise is probably a signal to other beetles. When you pick them up, they give out an ill-smelling, whitish liquid to induce you to drop them. Through the winter they lie torpid among the roots of water plants, and come out in spring. Their larvae—curious, slender creatures with six thin legs and many pairs of fringed gills along the body—also feed on other insects.





Rove Beetle and **Whirligig.**—At the left, twice natural size, the larva of a rove beetle, mostly carrion feeders, but some live among fungi and flowers. At the right, enlarged, the larva of a whirligig beetle; notice the long, tapering gills fringed with fine hairs. It feeds on insects and plants.

TUMBLE BUG.

Some small beetles have the odd habit of rolling up little balls of manure and of laying their eggs in them. Then they bury these balls in the earth. They do this to supply the larvae with food. The beeetles may sometimes be found rolling these balls out of the traveled road to some safer place. They are blackish, or bronze, or greenish and red, in color, and since they frequently tumble and turn somersaults ouver the balls they are rolling, they have received the name of tumble bugs. They are not bugs, however, but beetles.

MANUAL

Giving Additional Notes and Topics to Accompany

"Farm Friends and Spring Flowers."

I'M GLAD.

By Eugene Thwing.

(The first part of this poem is primarily for pupils.)

I'm glad I'm heir to boundless wealth, displayed on every side.
I'm glad my treasures fill the earth, abundant, far and wide.
I'm glad I own the trees and rocks and all the grass and flowers.
I'm glad the deep blue sea is mine, the hills, the leafy bowers.
I'm glad the birds belong to me, the butterflies, and bees.
I'm glad I have refreshing rain, and cooling summer breeze.
I'm glad I sometimes have the storm to rouse my sluggish soul.
I'm glad to see the lightnings flash and hear the thunders roll.
I'm glad I need not guard this wealth lest anything be lost.
I'm glad it need not be insured to cover all its cost.
I'm glad the burden is not mine to care for sea and land.
I'm glad he holds them safely in the hollow of His hand.
I'm glad for true and loyal friends, who cheer a fellow on.
I'm glad for those who know they're friends before the victory's won.
I'm glad for chance to be a friend, to pass the cheer along.
I'm glad to steal away a sigh and substitute a song.

(The lines that follow will be of most interest to teachers:)

I'm glad the dollar sign is not the only mark of wealth.
I'm glad it cannot measure life, or light, or bounding health.
I'm glad a poor man may be rich and free to give or lend.
I'm glad that such investment brings a noble dividend.
I'm glad for laughter, fun, and play, to keep the spirit sweet.
I'm glad the serious and gay are making life complete.
I'm glad there's room for singing in the crowded, busy day.
I'm glad that music in the heart makes work as light as play.
I'm glad I needn't work alone, nor carry all the load.
I'm glad a Friend walks by my side and cheers me on the road.
I'm glad the heaviest burden leaves a little strength to spare.
I'm glad there's power enough, withal, a brother's load to share.
I'm glad my task is greater than my puny strength can grip.
I'm glad to have so sure a claim upon God's partnership.
I'm glad that when men say, "You can't," my heart responds, "I will."
I'm glad the steep ascent leads to the summit of the hill.
I'm glad things called "impossible" I sometimes dare to do.
I'm glad, with faith that "nothing shall be impossible to you."

THE ROSE IN LITERATURE.

Poetry is lavish of roses. It heaps them into beds, weaves them into crowns and garlands, twines them into arbors, forges them into chains, "adorns with them the goblet used in the festival of Bacchus, plants them in the bosom of beauty—nay, not only delights to bring in the rose itself upon every occasion, but seizes each peculiar beauty it possesses as an object of comparison with the loveliest works of nature."

The rose is the emblem of joy and love. In the Greek myth, it was the flower of Venus, the goddess of beauty, from whose heart it was said to have sprung. Among the Romans the youthful Comus, the god of feasting, was crowned with a garland of crimson roses "gemmed with dewdrops." The Turks believed it wicked to step upon a rose petal or to leave one lying upon the ground. The Persian poet Attar wrote that all the other birds appeared in anger before the throne of Solomon, asking him to destroy the nightingale, which would not allow them to rest by night, but poured forth his lays when peaceful silence should reign. After argument the bird was acquitted, for it explained that its untimely melodies could not be restrained because of its frenzied love for the rose, "a passion so hopeless and undying that it could never be made voiceless." Another Persian belief is that nightingales always die beneath rosebushes, stupefied by the scent. Jamie, a Persian poet, wrote of how "the first rose appeared in Gulistan at the time the flowers demanded a new sovereign from Allah; because the drowsy lotus would slumber at night. At first the blossom was snow white, and encircled with a protecting guard of thorns, but the nightingale fell into such an ecstasy of love over her charms, and so recklessly pressed his heart against those cruel thorns, that his blood dyed it crimson."

The Greeks accounted for the red color by supposing that Venus had stepped upon a thorn which pierced her foot and the drop of blood changed the white rose to a red one. Poets have fancied that the angels possess a more beautiful knd of rose than we have on earth; and the poet Cowley represents King David as seeing angels pass by him in a vision, scattering flowers from gilded baskets in their hands:

"Some, as they went, the blue-eyed violets strew;
Some, spotless lilies in loose order threw;
Some did the way with full-blown roses spread,
Their scent divine, and color strangely red;
Not such as our dull gardens proudly wear,
Whom weathers taint and winds' rude kisses tear.
Such, I believe, was the first rose's hue,
Which, at God's word, in beauteous Eden grew;
Queen of the flowers that made that garden gay—
The morning blushes of the spring's new day."

Our common thistle of the dry plains grows 1 to 4 feet high, with leaves partly clasping, prickly, white-woolly on both sides; flowers mostly larger than shown here, purplish to nearly white.

The Canada thistle has smaller heads; it should be promptly exterminated wherever it is found.

To Classify Your Ant.—How may we classify the emmet or ant race? Ants belong to the insect family known as Formicinae, which is divided into four sub-families. Of these sub-families, we have three very common in the West. A simple key, devised for this article by our friend Chamberlin, will enable us to identify the sub-families. The "pedicel" is the slender waist of the ant; the "nymphs" are the immature ants or pupae, often miscalled ant eggs; the large, whitish stage of the creature just before it becomes an "imago" or perfect insect is the cocoon. We refer a specimen to its sub-family, thus:

A. Pedicel of two joints—Myrmicidae.
B. Pedicel of one joint:
    1. Nymphs naked—Dolochodorinae.
    2. Nymphs in a cocoon—Camponotinae.

Every member of the first named group (A) has a well developed sting; of the second (B), only a rudimentary sting; the third has its sting transformed into a mere support for a poison gland. Therefore if an ant stings you, you have at least the satisfaction of knowing—what the ant does not know—that it belongs to the first group. Most of our ants have stings.

OTHER NOTES ON SPIDERS.

Poison of Spider Bites.—We are asked about the poisonous nature of the bite of the tarantula. It is undoubtedly poisonous. Most insect and spider bites are more or less so, while the sting of the scorpion causes inflammation and sometimes rather serious trouble. But, in general, the evil effects attributed to spider bites are overdrawn. For though birds shut up with the large tropical spider Mygale, corresponding to our lion spider, died in a few seconds after being bitten, yet Doleschall, who was bitten in the finger by a jumping spider, felt the pain for only a few minutes, though the hand and arm were lamed for a little time. Bertkan relates that the bites of spiders on his hands were similar in results to those of mosquitoes. Blackwall made several large spiders bite his hand and arm, and at the same time pricked himself with a needle. There was no perceptible difference between the prick of the needle and the bites of the spider. We read that people on the isthmus and in Mexico are often bitten by spiders large and small without fatal or even serious results, but that some persons are laid up temporarily by deep stings of the whip scorpion, the bite of which, in popular tradition, is reputed to cause immediate death. The latter story also is probably an error and the illness may be due to bites of other creatures, since the whip scorpion has no poison in its sting. Its formidable appearance may have given rise to the belief that its sting is dangerous.

One of our tarantulas escaped at the Training school, causing needless alarm among the children till they were told that the creature is well nigh harmless. Spiders are poisonous to be sure, the claw of the mandible having near its point a small hole, which is the outlet of the poison gland. The poison is strong enough to kill or disable the insects captured for food, but the effect on the human skin varies with different persons. "Sometimes," says Emerson, "it has no effect at all; oftener it causes some soreness and itching like the stings of mosquitoes and bees, and cases have been known in which it caused serious inflammation which lasted a long time." The same authority says that spiders seldom bite, and only in self-defense, the bites so commonly charged to them being often the work of other animals. From all that the writer can learn, the supposition that the bite of the tarantula is fatal or especially dangerous is speculation; though the effects of the bite are likely to increase with the size or liveliness of the specimen, those further south being more troublesome and venomous than the northern members of the genus.

European Spider Traditions.—It has been remarked that our lion spider is different from the true European tarantula. The latter was named from Tarentum, Italy, where it is found abundantly. According to Italian folk lore, the bite of the tarantula would be speedily fatal unless all the townspeople should drop their work and engage in behalf of the sufferer, in an all-night dance. The soiree was supposed to exorcise away the evil effects of the poison upon the person bitten. The bite of the tarantula probably produced a kind of hysteria in the patient, and the dance might have originated from sympathetic imitation of the patient's movements.

The duel between these two magnificent species the tarantula hawk and the great western spider offers a fine field for observation.

Trap Door Spiders.—The tarantula lives in a silk-lined burrow similar to the one in which he is finally eaten in case he encounters the tarantula hawk. Other members of his family not only dig holes and line them with silk, but construct trap-doors for these burrows, closing them from within after they enter the burrow. Pachylomerus, a genus common in New Mexico, California, and Arizona, digs its hole in a fine soil which becomes hard as a brick when dry. The holes may be nearly an inch in diameter and from several inches to a foot in depth. A cover is made of dirt fastened together with threads and lined with silk. When in its home the spider holds this lid so tightly closed that the lid will break before it will open.

One of the trap-door spiders in captivity soon made a burrow. Then it covered with silk and used as a lid a copper cent which was placed within its reach. Thus the hairy tarantula (E. hentzii) is less skillful than the members of other tribes of its family. Like the rest of them, E. hentzii is relatively low in physical organization, having four, not two, lungs as in most spiders, and weaving no webs except the silken lining of his burrow. Tropical America and Asia have large species closely related to our lion spider. They are, like ours, four-lung spiders. The bird spider of Surinam has a body two inches long, pitchy black, and covered with long, reddish brown hairs. It is said that it catches birds, kills them with its poisonous bite, and then sucks their blood.

Spider Wasps.—The family Pompilidae, to which the great wasp the tarantula hawk belongs, are all slender in form, and have long legs, with which to keep at bay the spiders they attack. Their bodies are black and the wings commonly a dusky red, but these may be variegated with orange. As far as known, the tarantula hawk is the largest of our hymenoptera. It is found only where the hairy tarantula, or lion spider, abounds; that is, in the southwestern portions of this country and Mexico. About 140 species of the family are known. Most of them dig a series of holes in the ground, as does the tarantula hawk, while a lesser number construct cells of wet mud on the side of a tree, rock, bank, or board; and after the mud hardens bring in a spider and lay an egg beside it. Each one preys upon only a certain kind of spider. Thus, the balance is maintained. The wasps keep down the number of the spiders; while the number of wasps is in turn limited by the supply of the spiders upon which their larvae feed.

TOAD BIOLOGY.

Male toads, which do the singing for the toad family, arrive in the ponds late in April; and, if the weather is warm, they sing both day and night. The females arrive soon after.

The eggs are laid in long, curling masses stretched from weed to weed in shallow parts of ponds. They are arranged in a single row in a transparent, jelly-like, cylindrical mass, and are fertilized in the water as they are laid. When the eggs are first laid, the jelly-like substance about them is scarcely visible but contact with the water soon causes it to swell and to become very conspicious.

The eggs are of incredible number, from 4,000 to 12,000 having been counted in a single laying. Within twenty four hours all of the fertilized eggs turn black; and on the second day the coils begin to straighten and to lose much of their solidity. At this time the eggs become tiny tadpoles, the head and tail of each being easily discernible. Four days from the time of laying, the tadpoles are to be found out of the jelly mass and clinging to its side or to nearby water weeds. The rounded head is uppermost and the tail with its thin fin hangs below. Where the mouth should be, we now find two suckers which secrete a sticky substance by means of which the tadpoles attach themselves to the weeds. The jelly mass soon becomes wholly disintegrated and foul. On the sixth day, finger-like appendages appear at the neck of each tadpole; they are gills for breathing; and though they have been present for forty eight hours, they have not been discernible. Everywhere now the tadpoles are swimming about vigorously. When just one week old, the gills seem to become smaller and to fade towards the tail; and a membrane is growing from the anterior part of the head. On the eighth day, the gills are almost entirely covered; on the tenth day we have veritable polliwogs, black as tiny coals, with constantly wiggling tails and mouths hungry after something to eat. The mouths, which are now open for the first time, are provided with horny jaws for nipping off weed tips for scraping. At the end of from four to six weeks, the tadpole is about an inch in length; and it is breathing by means of internal gills. The tail is still conspicuous. Soon the hind legs begin to appear, and in ten days thereafter the front ones suddenly appear fully formed. Now we have a funny looking creature with four legs and a tail, and with a mouth that more resembles that of the full grown toad. Day by day the tail mysteriously becomes shorter until it is a mere stud and finally disappears altogether. Just prior to the completion of the metamorprosis, the tadpoles appear to like the land better than the water; for if confined to the water, they make frantic efforts to reach to the top and exchange a bubble of foul air for fresh. As soon as the tails disappear, the toads are likely to leave the pond, covering the ground about in countless numbers as attractive and cute as anything imaginable. If touched, they play dead, sticking up their fat little hands in most ridiculous fashion. So fast do they grow that they shed their skins every few weeks. This is done by humping the back, causing the skin to split along certain lines, and by eating the skin by a constant pull-ing at the corners of the mouth. . It is an interesting process, though one rarely is lucky enough to see it. The new wet skin soon dries and our toad is back to himself again.

LIFE HISTORY OF THE FROG.

Frog eggs are laid in masses in shallow water in early Spring. They may be attached to sticks or grasses or left free to float in the water. A laying is usually about five or six inches in diameter, and contains from five to six thousand eggs of velvety black color. In fact the entire mass is black colored, so close are the eggs together. If we look closely at the eggs, however, we discover that they are of a creamy shade underneath; each egg contains not only the germ of the future frog but the yolk to feed him with as well. Development begins within two or three hours after the laying; and is shown by the egg's becoming slightly larger and by the appearing of a little groove line at the top. This line increases until finally it encircles the entire egg. A second groove appears at right angles and encircles the first. Other grooves appear until the entire egg is encircled several times both ways. Before the third day, the eggs become elongated, and a heavy groove is formed along the top to correspond with the back of the future frog. By the fourth day the groove widens and the folds of the surface slowly fold in over it; and on the fifth day the elognation of the egg is so noticeable that we can readily distinguish head and tail ends. On the sixth day the body seems much thinner and the projections on the side of the neck appear quite distinct; and on the seventh day the fins on the side of the tail appear. On the ninth day, however, we find the tadpoles out of the egg, clinging by two conspicuous suckers to the deserted jelly masses or to water weeds. The casting off of the jelly substance is interesting; the tiny bit of life wriggles and twists until it is free, and then goes to the bottom to rest until strength arrives sufficiently to enable it to swim to a weed leaf. The tadpole is black and has a slender transparent tail-fin. A number of hairs appear on the body, and these, by causing a circulation of the water, assist the tadpole in breathing until it's gills are fully developed. Day by day the body increases in diameter, as the tadpole swims aimlessly about, and on the sixteenth day the mouths open. Now the young tadpoles swim directly to the tender weed ends and nibble at them and at the green moss on rocks. Their enemies are many at this time, and the water tiger, in particular, is constantly in pursuit with his mammoth jaws. The tiny tadpole glides to nibble the end of what appears to be a green stem when all at once the stem takes life, as it were; tongs shoot out and take the young tadpole to the jaws of the water tiger. Fish, turtles, waterbirds, and even frogs themselves prey upon the tiny tadpoles.

Early in May the tadpoles that have survived all these dangers are more than an inch long, the tail being nearly twice as long as the rest of this interesting little creature. Soon the hind legs bud out and develop, the front legs break through, and the eyes and mouth are transformed into those of a frog. The tail is gradually absorbed. In July and August the water-lily ponds and the grass-covered stream shores are swimming with small frogs, each wandering over sedges and weeds in search of the insect life upon which he feeds. At the slightest disturbance all rush to the water with a splash so slight as scarcely to ruffle the surface of the quiet pool. They hide at the roots of grasses or in water weeds until we are tired of searching for them. In the wet meadows we may now see thousands of them greedily eating spiders, beetles, crickets, grasshoppers, and small bugs and flies. The legs of one grasshopper may still be protruding when another is taken, as many as eight or nine being eaten in succession.

THE BADGER.

The badger is worthy of our protection as a useful dweller in the wilds. It ranges throughout the dry, untimbered regions. The favorite habitat is a dry, rolling flat of light gravelly soil where numerous ground squirrels make their home. One never sees a badger in swampy grounds. Every badger probably spends its whole life on a piece of ground not over two miles square, and will work all summer in a twenty-acre field. Trapping, poison and the destruction of ground squirrels have all served to deplete the numbers of badgers just as ploughing has discouraged them, nevertheless, there may be one badger to every square mile of fertile, gravelly ground.

The genus Taxidea, to which the badger belongs, comprises large animals of the weasel family, having thick, heavy bodies, short tails, short legs, powerful front feet with long claws and short ears. An ordinary badger is 28 inches long, the females weighing from 10 to 16 pounds, and the males from 14 to 23. In general the color is a silvery grey above, each hair being, however, yellowish white at the base. The neck, crown and muzzle above are brown; but the cheeks, chin and a stripe from the nose over the head to the shoulders, are white. The under parts are yellowish-white and the tail yellowish brown; but a bar on each cheek, the backs of the ears and the feet are dull black.

Each badger in summer probably makes a new burrow every 24 hours; hence, there being little to distinguish the new from the old, few have spaded persistently enough to unearth the real home. In the spring the female prepares a nest of grass in a dry hole two or three feet below the surface, in which from two to five, usually three, young are born late in May. It is supposed that the little ones remain in the den until big enough to dig for themselves, or until a year old. A badger is made to dig, not to run; hence a man can easly overtake one. Capture is difficult, even then; for if given loose dirt and a fair start, a badger can actually dig a new hole and bury himself in it before one can come upon him. A winter sleeper, he does not appear until the snow has gone; and then all summer long he basks over his burrow at sunrise. Rarely does he venture far from home; if discovered in such a predicament, he shuffles about, bewildered in search of a retreat. If actually cornered, a badger may snarl and advance as if attacking, but he is only making a last desperate effort to reach the burrow. There it is safe, for no one can dig fast enough to capture it; and unless water is poured in suddenly by the barrel it will plug the burrow and avoid drowning. Protected by a loosely-fitting hide, a badger may withstand the grip of a bulldog without choking or ceasing to fight. Its strong jaws leave a gash at every bite, and the little animal never surrenders. It can whip any dog twice its size, and sometimes keeps off as many as, four of the "yellow" variety. It is said that a seven-year old boy once lost his way and took refuge from the rain in a badger den. When the animal returned it scratched him on the face, but afterwards made friends and brought the lad food every day for two weeks. The boy cried on being compelled to leave his friend. But a big badger entered a back porch and nearly killed a little child in Big Cottonwood last year. It held the little one by the throat until shot dead.

WESTERN OWLS.

With a flight as stealthy as that of a bat, an eye accustomed to the darkness of night, and an appetite for those things of which man would rid himself, the owl truly deserves our highest respect and most assiduous proctection. In the west we have many species, only one, if any, being at all detrimental.

The Long-eared Owl, one of our commonest species, a bird over a foot in length, particularly merits our attention. Its ear tufts are dark brown, its face yellowish brown, its under parts whitish and yellowish with dark-brown shaft-streaks and horizontal bars, while the upper parts are mottled gray, tawny, and blackish. It lives almost exclusively on injurious rodents, which it destroys in vast numbers. Its nest, generally 10 to 30 feet from the ground in bushes or trees beside swamps or streams, is usually a crow's deserted home built up on the sides and lined with grass, dead leaves, and feathers.

The Short-eared Owl, from 13 to 17 inches long, has inconspicuous ear tufts; eyes with black rings and white eye-brows; body varying from yellowish brown to buffy white, conspicuously streaked with dark brown; wings and tail irregularly banded with dark brown and buffy or yellowish; the nest is built of coarse grass and sticks loosely put together and lined with the feathers of birds. Its food consists largely of mice, gophers, shrews, rabbits; grasshoppers, crickets, and beetles are also taken.

The Saw-whet Owl, occasionally seen here, is from 7 to 9 inches long, has the under parts white, streaked with reddish brown; eye ring whitish; face streaked with dark brown; upper parts olive brown; feet, plain white or buffy. Its nest is a deserted wood-pecker home. Its food consists almost entirely of mice, other small mammels, and insects.

The Screech Owl, length 7 to 10 inches, has upper parts dull brownish gray, with shaft streaks of dusky; lower parts grayish white with heavy shaft streaks and light cross lines of black. Some specimens have the upper part rich rufous and lower parts streaked with rufous and white. The nest is in a holllow tree. The food consists of mammals, birds, reptiles, batrachians, fish, crustaceans, and insects.

The Western Horned Owl, a bird from 18 to 23 inches long, with ear tufts blackish; iris, bright yellow; black face ring, white throat; under parts white or buffy, mottled and barred; brownish buffy flanks; upper parts mottled dark brown, light grayish and buffy. This owl is unfortunately a bird of bad habits. It will eat poultry, song birds, water fowl, and game birds; though rabbits, prairie dogs, ground squirrels, and wood rats are also taken. Its nest is built in a tree, hole, cliff, or cave.

The Snowy Owl, nearly pure white, length 20 to 23 inches, is a winter visitor to the plateau, living on fish, rabbits, musk-rats, squirrel, rats, ducks, and mice. Its nest is on the ground in the far north.

The Burrowing Owl, length 9 to 11 inches, has upper parts dull earthy brown spotted and barred with buffy; under parts buffy, barred with brown. It lives in burrows and eats ground squirrels, young prairie dogs, mice, gophers, frogs, lizards, horned toads, fish, crickets, grass-hoppers, beetles, scorpions, and centipides.

WESTERN EAGLES.

Golden Eagle.—Picture a wild mountain scene—a canyon gorge consisting of rocky walls of bewildering height, a turbulent, cold stream, verdure and lonely clinging trees, and, withal, majestic peaks looming from the sky above, like giants looking down upon their cavern;—and then imagine seeing a great brown bird with wings nearly seven feet across their spread, soaring, turning, scooping, an drising in the space between the sides of solid rock. It is the golden eagle, one of the largest birds in the world and one whose home is in the highest reaches of the Western mountains. You may tramp the mountain sides a lifetime and see but one pair of these stately birds. A characteristic of most eagles, is the fact that they mate but once. The nest consists of a platform of grass, moss, leaves, fur, feathers, and the like, placed in high trees or on the edges of cliffs. The food of the golden eagle consists of birds, squirrels, prairie dogs, spermophiles, rabbits, fawns, lambs, turkeys, grouse, and waterfowl. Two of them were one time seen near Great Salt Lake eating a full grown fox which they had killed. They seldom eat carrion.

The Bald Eagle is sometimes larger than the golden eagle, the spread of the female's wing at times reaching eight feet. It is readily distinguished by the white of its head, neck, tail, and tail coverts; though the young are wholly black during the first year, except for white bases of feathers showing through. It is not a common bird in the West; it is seen most often in the neighborhood of mountain lakes and ponds where fish abound. This bird was unfortunately selected as our national emblem, though the more princely golden eagle would not be guilty, ordinarily, of robbing or of eating carrion, as the bald eagle does. Its nest on cliffs or in high branches, consists of a bulky mass of sticks, weeds, seaweed, moss, turf, plant stalks and vines. Its food consists mostly of fish, though rabbits and other small mammals are taken when they appear handy.

WESTERN HAWKS.

An easy prey to the thoughtless gunman, conspicuous of habit and therefore easily disturbed in his home, the hawk unfortunately is becoming scarcer every year. Only three of the list can be said to do damage to man, namely, the sharp-shinned ,the cooper, and the goshawk, but careful observation of their habits will disclose good as well as harm. The only safe course to pursue is not to kill any hawk at all, for the beneficial and the detrimental species are not easily distinguished at a distance of twenty-five yards or more. Few people can detect the difference between a Richardson merlin and a sharp shinned hawk at a distance of only a few feet, yet the first is always doing good and should in no case be destroyed.

The Marsh hawk, a bird of bluish white color and wings nearly two feet across, with a facial ruff and a large white rump patch, lives in the marshes and eats meadow mice, young squirrels, rabbits, lizards, frogs, snakes, birds and insects. Seldom, if ever, does it approach the poultry yard.

The Sharp-shinned hawk is easily distinguished by the horizontal bars thickly marking its entire under side including the under tail; its upper parts are nearly uniform bluish gray; and it is nearly a foot in length. It eats birds and poultry with a few mice, reptiles, batrachians and insects.

The Cooper hawk, another with a bad reputation, has the underside thickly spotted and barred with reddish brown while the black head top strongly contrasts with the bluish gray of the back. It is over a foot in length. Like the sharp-shinned, it lives almost entirely on wild birds and poultry, but occasionally takes insects, reptiles, and batrachians.

The American Goshawk is a bird nearly two feet in length with the under parts finely penciled and uniformly covered with gray zigzags touched with dark shaft streaks. The upper parts are dark bluish gray. This bird also lives principally on poultry, ducks, grouse, small birds; but does at times eat rabbits and rodents.

The Western Red-tail hawk is nearly two feet in length with a bright reddish brown tail and under parts varying from buffy or nearly white to dark sooty. It is a beneficial bird, because it eats squirrels, chipmunks, mice, snakes, lizards, frogs, grasshoppers and other insects. Next to Swainson's hawk, it is the commonest of the larger raptores found in this region.

The Swainson hawk is probably commoner than all other hawks combined, in the intermountain plateau. It is not quite two feet long and has white throat and belly, contrasted with a reddish brown chest band; the upper parts are nearly uniform dark grayish brown. It is our most beneficial hawk, living almost entirely on small rodents, principally striped gophers and mice, together with grasshoppers and crickets. One thing that should be remembered is, that the destructive hawks are nearly all small; the large ones are, nearly without exception, of benefit to man. The Swainson is a peaceful hawk and even permits the Arkansas kingbird to build its nest either beside or directly beneath its own.

In the winter you may see the Rough-legged hawk, a bird nearly two feet in length with upper parts heavily spotted with blackish and upper parts grayish brown streaked with white and reddish brown. A distinguishing feature is its white upper tail coverts. It lives on mice and rodents.

The Squirrel or Ferruginous hawk is found throughout the plateau. It is less than two feet long, has white under parts sometimes streaked with brown, upper parts and flanks, reddish brown, and a white tail more or less stained with reddish brown. It lives almost entirely on small mammals and reptiles as well as crickets.

The Prairie Falcon (Falco mexicanus) with its upper parts of pale clay brown and lightly spotted white under parts is about 17 inches long. It loves the sage brush country and lives on small birds, mammals, insects and reptiles.

The Duck hawk, 15 to 18 inches long, with a sooty black head top and slaty blue upper parts, follows the waterfowl throughout their migrations living entirely upon them.

The Pigeon hawk has buffy underparts very heavily striped, the stripes diminishing at the throat; it is less than a foot long. It lives mainly on birds and insects.

The Sparrow hawk, which is distinguished by the two black stripes on its cheek, is between 8 and 10 inches long. It does much good in killing English sparrows.

The Fish hawk, two feet long, with oily plumage, head, neck and under parts white and a broad black streak on each side of the head, lives, as its name would indicate, entirely on fish.

THE SUGAR BEET.

The genus Beta, includes the garden beets, sugar beets, and mangelwurzels. The plants are biennials. Their food supply is stored up the first season in their thickened stems and primary roots. This food serves as nourishment for the fruiting stem in the second season. The neck that supports the leaves of the beet should be short; the flesh should be firm, with no tendency to sponginess or hollowness. The fibrous root system of the beet is extensive; drains four feet below the surface have been blocked by them. Sugar beets differ from mangels in color, form, size, depth, and in vigor of growth. The skin is white, sometimes red; in mangels the color varies with the variety from white to black. Beets may be placed in five groups with regard to their form: long, half long, ovoid, tankard, and globe. Typical sugar beets weigh from 1 to 1½ pounds. They grow almost entirely below the surface of the soil. They usually contain about 20% of dry matter, four-fifths of which is sugar. The two varieties which have been most widely grown are the Vilmorin Improved, and the Kleinwanzlebener. The essentials of a good variety are large yields, high sugar content, purity of the juice, and the keeping quality of the beet. The beet should have an even texture, smooth outline, and symmetrical shape.

Soil and Seed.—The beet is adapted to a cool climate and moist soil. Sunshine is especially necessary where high sugar content is desired. Beets respond well to irrigation but should not be given too much. At the Utah Station, five irrigations of four inches each gave larger yields of beets and higher percentage of sugar than by using less or more water. The soil for beets should be in good physical condition and care should be taken in its preparation. Deep fall plowing with spring discing and harrowings are necessary.

What is sold as beet seed is the fruit of the beet. It is called "bolt." Each pod contains from one to five seeds. It is the local custom to sow from 18 to 20 pounds of "bolts" per acre. Perhaps from ¾ to 1 inch under the soil is an ample depth in planting. Sugar beets may be planted in rows about 20 inches apart. Where they are irrigated, it may be better to plant in double rows, 11 inches apart, with 27 inches between the double rows.

Thinning and Cultivating.—After beets have come out of the ground, and as soon as the plants have four leaves each, we chop out with a hoe all the plants in the row except a little bunch every 6 to 10 inches. This bunch must next be thinned to one plant. The ground should be frequently harrowed after seeding to keep weeds from starting. Shallow cultivations should be given every ten or fifteen days until the tops from the adjoining rows meet. Beets are usually harvested in October when the outer leaves begin to wither. The crown is always cut off. For the production of seed, mother beets are selected. These must have a good general appearance and a high sugar content. The selected mother beets are sampled, then stored until the next spring. Then they are again planted, and will produce seed that year.

History.—In 1747 Marggraf, of Austria, proved that beets contain sugar. The first factory was erected in Silesia in 1799; but it was not until 1825 in France and 1835 in Germany that the manufacture of sugar from beets became much of an industry. Fifty years later three million tons of sugar were manufactured in Europe. The principal beet sugar producers are: Germany, Austria, France and Russia. In the United States the first attempt was made in 1863. The sugar beets in the United States are grown chiefly in California, Colorado, Michigan, and Utah. We may take, for indoor study, a collection of the seeds and the tubers of various root crops such as beets, turnips, ruta bagas, parsnips, and carrots. To understand this subject, seed should be planted and the methods of growth of the various crops studied. Fields of other beets should be visited and the growth of the beet seed noted.

OTHER PLANTS FOR SCHOOL GARDENS.

The pea can be seeded early, since it withstands considerable cold and prefers coolness and moisture. Plant the seed in rows that are about eight inches apart, in good, rich soil, and cover the seeds two or three inches deep. About 74 per cent of good seed peas will germinate.

Onions can be planted early. They require a very fine, well-prepared seed bed, with the soil in perfect condition, rich in organic matter, mellow, and finely pulverized. For onions, the soil can hardly be made too rich, and they should never be planted on new soil. The rows may be about twelve inches apart, and about thirty seeds may be sown to the foot. It is not safe to plant more deeply than about an inch, less rather than more. Ninety per cent of the seed may be expected to germinate, but the young crop will not thrive unless all weeds are kept out.

Radishes require a cool, moist soil, and being uninjured by ordinary frosts may be planted early. The rows may be from six to twelve inches apart; and the seed should be covered by only half an inch of soil. Two or three plants to the inch may be raised, thinning out as they get ready for use. The germinating power of these seeds averages 75 per cent.

Lettuce is usually started in window boxes, where it is sown broadcast and covered with half an inch of soil firmly pressed down upon the seeds with a small board; and this plan is followed also in outdoor planting. When the window plants are two or three inches high, they are transplanted and soon outgrow those that are of the same size raised in the garden without transplanting. The plants should be transferred to the garden on a cool or cloudy day when no wind is blowing. The garden rows may be a foot apart. About 80 per cent of the seed germinates. Other window-box plants are the cabbage, Kohl Rabi, Brussels sprouts, tomato, egg plant and pepper.

Parsnip seeds must be fresh, as they lose their power to germinate if kept over one year. The seed is sown one-half to one inch deep; the seeds germinate slowly, sometimes requiring four weeks. After they come up, thin them out till the plants stand about four inches apart; the rows may be fifteen inches apart. The germinating power of these seeds is low—about 50 per cent.

Beets may be planted very early, in rows twelve inches apart, and covered with one or one and one-half inchesof soil. They are sown in continuous rows and thinned out after they come up till they stand six inches apart. About 80 per cent of the seeds germinate; they should be soaked for from twelve to twenty-four hours before planting.

Spinach is sown in rows twelve inches or more apart, and covered with an inch of soil. About 65 per cent of the seeds germinate.

Early Start.—To have vegetables as early as possible, start seeds indoors early in spring. For this purpose prepare a number of shallow boxes, about 18x30 inches. The boxes are filled with fine, rich, sifted earth. Sow the seed, then water carefully and keep the soil clean. Give the boxes a sunny window in a moderately warm room and keep them covered with a glass in cold weather. On warm days it may be necessary to place a strip of muslin between the plants and the sun. As the plants develop, they must be transplanted to prevent overcrowding and to induce a stocky growth. Plant indoors the tomato, cabbage, egg plant, and pepper.

Garden soil must be worked when it is dry, and it will be trampled into clod surfaces if we go upon the land while the ground is wet. We determine when the soil is in good condition by taking up a small quantity of it and pressing it in the hand. If it sticks together, like a fresh-made pie, it is too wet. If, on rubbing in the hand, it crumbles or falls to pieces, it is dry enough. Another way is to note the appearance of the soil in spading or plowing. If it turns up sleek and glistening, it is too wet. If it falls apart, with no reflective surface, it is dry enough. For flower beds or borders and for the very early vegetable beds the best means of breaking the soil is with the spade or garden fork. Spade the soil deeply. As you spade, work into it manure or other fertilizers that have been placed on the surface. Thrust the spade into the soil the full depth of the blade, lifting and turning the soil in the same operation. Work each spadeful of soil with the spade to a fine consistency as soon as it is turned. Leave no large lumps below, but make all fine and of even texture. After the bed has been spaded and worked down with the spade, as the lifting and turning were done, apply the rake. Use a heavy, steel-toothed rake that will dig down and pulverize the soil. The object in working down the soil is to make it fine and firm. If the soil is quite dry, walk on it as the raking is being done, making the weight of your body compact the soil. The compacting brings all the soil particles into close contact and establishes free upward capillary movement of soil moisture. Time is saved if the seed is soaked before planting. This is often done with large seeds, but with small ones is seldom practiced except by market gardners. Melons, cucumbers, and tomatoes are much better for the treatment. Put them in water that can be kept at a temperature of 85 to 90 degrees all day, then pour off the water and cover the seed with a thick cloth and place them where they will be only a little below

100 degrees all night. Some growers plant them the next day, while others wait till the seed shows signs of sprouting.

THE LIFE IN THE SEED.

In some respects, seeds are among the most wonderful things known. They look dead and helpless, but have a marvelous and invisible mechanism within, through which works the mysterious force of life. Why one seed produces corn while another produces beans; why the small seed of the elm should develop into a large tree, while the large seed of the gourd gives rise to only a short-lived, weak-stemmed plant; why some orchids with immense blossoms should bear seeds that are dust-like in minuteness, while the small flower of the box elder should produce seeds so large; why the oak should live thousands of years, the mushroom only a day or two; why the seed of the coffee berry should refuse to grow unless planted just as soon as it has ripened, and the willow seed should retain its vitality for only a fortnight after it has matured, while melons have been known to germinate after being kept wrapped in paper for thirty years—these are facts that belong to the mysteries of nature not yet explained by man. Cases have been known in which very small seeds have retained their vitality for centuries; and Dr. Lindley raised raspberries from seeds found in British Celtic mounds that were perhaps 2,000 years old. The oft-reported cases of the great vitality of the mummy wheat, however, are without foundation; for the grain of wheat, being entirely unprotected except by a thin husk, loses all power of germinating in a few years. Grain taken from mummy cases has been made to grow, but it was recently put there by the Arabs. In one instance the plant raised was oats—a grain not known to ancient Egypt.

Seed and Germ.—The seed contains the germ, or young plant, surrounded by a nutritive layer, which is stored there for the purpose of nourishing the plant while it is still too young and weak to secure its nourishment from the soil. The nutritive layer of many farm seeds is composed of starch and sugar, and these are valuable as food for man and beast. The starch and sugar we often call heat-and-energy-producing foods. The germ, in most seeds, is relatively small and is composed largely of protein substances and oil, which have high food value. The protein materials are often called muscle-making foods; they are similar in composition and value to the lean meat of animals and the white of an egg. The germ is a perfect miniature plant.

Germination.—The seed must contain a living germ or it will not sprout. Some seeds germinate quickly and strongly, while others are slow to sprout, and produce only weak or spindling plants. The seeds of farm crops which most often give inferior yields by reason of weak vitality are corn, wheat, oats, potatoes, blue-grass, and clover. The influences which affect the vitality of seeds are maturity, age, size, kind of seed, pedigree, method of production, climate, method of preservation, repeated germination, and chemical substances.

Vitality.—The power of seeds to germinate is diminished if they are not thoroughly mature or ripe at the time of planting. Seeds will often germinate when they are immature, but they will then produce only weak plants, which easily succumb to unfavorable conditions. All seeds lose their vitality with age. Seeds vary greatly in this respect, some retaining their vitality only one year, while others may be safely planted several years after gathering. Seeds containing much oil, such as sunflowers, corn and flax, lose their vitality much earlier than other seeds. Some seeds will not grow if at all dried after maturing. Many other seeds seem to improve in vitality by passing through a dry, resting stage after ripening. Most seeds are as good the second year as the first, if they have been properly handled. In general, beans, peas, corn and carrots are good for two years; lettuce, asparagus, and radishes for three years; cabbage and turnips for five years; while beets, melons, and squash should germinate when six to eight years old. Gardeners have long believed that two to four-year-old seeds of melon, squashes, and cucumbers are more desirable than fresh seeds, because they produce more fruit and less vine.

OTHER SPRING FLOWERS.

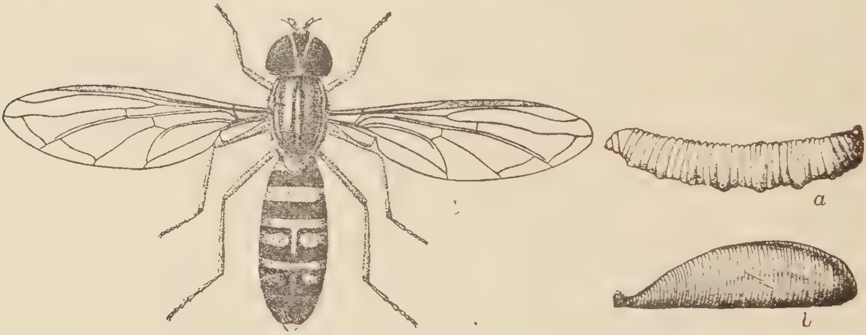
Blue Bells (Mertensia) are related to the forget-me-nots. The largest is smooth, pale-leaved, with flowers narrow bell-shaped, nodding in clusters, showy, pinkish, purple, or white. It grows in canyons. All the Borraginaceæ have fruits that split into 4 nutlets. Most of them are rough-hairy, with blue and white flowers.—Some of these plants are very hairy—the puccoons and others; or rough-bristly with yellow or orange flowers—the amsinckias; or silvery-hairy with white or yellow flowers crested the throat—cats-eyes or silver club. (Krynitzkia.)

Water-Leaf (Hydrophyllum) differs from the forget-me-not family in having a single ovary not separating into 4 nutlets, with large, petioled leaves, generally cut or pinnatifid, flowers bluish or white, in ball-like top bunches, or in more open cymes. These grow in moist places; but Phacelia, the dry water-leaf, is rough hairy, with white to blue flowers, on dry, sage-brush ground.

Fcur-parted Spring Flowers.—The hillside evening primrose Oenethera caespitosa, forms a small woolly rug from 6 to 12 inches in diameter lying close to the ground. It sends up many four-sided, blunt-pointed, spear-heads, an inch long; these are the buds. The large, fragrant, numerous, white, lily-like flowers, turning pink with age, form one of the most tempting and delicate of floral boquets for decorating a dining room table. The sand-hill primrose, (O. albicaulis) grows a foot or two in height, and is much branched, with flowers somewhat smaller and often inclined to be of rosy hue, even when young. The 4-celled pod and the 4-lobed stigma, and the 8 stamens with balanced, swinging anthers, are other points for observation.

The Mustard Family form a larger group of four-parted flowers, pods and seeds should be the objects of study, the flowers being very similar in all. The showy, yellow, rough-leaved wall-flower (Erysimum); the common, weedy shepherd's purse (Capsella), with its triangular, flat pods; the bittercresses (Cardamine) of the canyons, with erect stems and heart-shaped leaves; the common water-cress of the springs and fresh waters (Nasturtium); the rock cress (Arabis): the false flax (Camelina) with pear shaped pods on the long mainstems; pennycress, peppergrass, and best of all, the cultivated radish—all of these form good material for collection, observation, and report, by pupils of the fourth grade. The radish in bloom makes a good study of the 4-parted flowers, 2-celled pods, 4 long and 2 short stamens of this family. The root is now hollow, the sugar and starch having been sent up to produce flowers and seeds. Other roots that thus store food are the beet, parsnip, and potato, of three separate families—Chenopodiaceæ, Umbelliferæ, and Solanaceæ.

Rove Beetles move swiftly with the aid of their long, strong legs. They have the power to curve upward the abdomen, like a scorpion about to sting. They cannot sting, however, and the raising of the abdomen is simply a threat to frighten enemies. Most of the rove beetles are very small and many of the smaller kinds are predaceous, feeding on other insects. From the size of their tong-like jaws, we suspect that some of the larger ones also prey on other insects. In moist and warm countries, (California), swarms of the smaller kinds fly in air and get into one's eyes. Their bodies contain an acid fluid that burns and smells bad. Our common kind is very hairy and therefore called villosus; another, from its large jaws is called maxillosus. Both have the generic name Creophilus. Some are very bright colored—red and even cinnamon and violet colors are found among them.



Syrphid Fly, Larva, and Pupa, Much Enlarged.

The Syrphid Fly, whose larvae destroy plant lice by sucking their blood. The egg of the syrphid fly is often seen among the colonies of plant lice; it is small, white, smooth or wrinkled, and much longer than wide. The eggs hatch in a few days into small, footless maggots somewhat triangular in shape, and with a pointed peak for piercing the bodies of the lice, of which it kills scores in a day. This larva casts its skin as it grows, and finally becomes over ½ an inch long. Then it fastens its body to the leaf, the outer skin hardens, turns brown, and is called the puparium. In about ten days the pupa inside has changed to a two-winged fly, which pushes open the lid at the larger end of the puparium, and thereafter flies rapidly among the flowers to find its food—nectar and pollen—and to lay eggs among the aphids.

Stages of Insect Life.—Insects have four stages of development: First, the egg; second, the larva; third, the pupa or chrysalis stage; and fourth, the imago or perfect insect.

The Egg. The eggs are usually deposited on or near the food for the larvæ. They generally hatch soon after being laid, but with some insects they remain unhatched during the wintetr. In this case they are deposited where they are secure during the winter months, and are generally securely glued to some tree or shrub.

The Larva. Distinct names are given to the young or larvæ of different insects. The larvæ of butterflies and moths are called caterpillars. Those of beetles are called grubs, and when they live in trees they are called borers. The most common name applied to the larval form is worms. The larval stage is the growing period of the insect's development, and the one when the most harm is done by it. This stage may last from a few days to several weeks, and even months.

The Pupa. This is the chrysalis stage. When the larva has completed its growth it either spins a cocoon, or goes down into the ground and forms a cell, or in some other manner protects itself when changing from a larva to a complete insect. It remains in this condition, in some species a few days, while with others the winters are spent in this stage.

The Imago. The perfect insect (beetles, moths, butterflies, etc.), is the final stage in the insect's development. The insect grows no more after reaching it, and the remaining work is to support life until it deposits its eggs for another brood. The length of life in this stage varies as in the preceding ones, it may be for only a few days (this is often the case), and it may be for months. With some insects, the winter is passed in this stage. They find some shelter in which they hibernate, and appear again in the spring, when the eggs are laid for the succeeding brood.

DOUGLAS FIR BARK WEEVIL.
Natural size at right.

Weewils are called also snout beetles from the long snout which distinguishes them.

Testing seeds before sowing is necessary in order to show whether or not the seeds are viable—full of life and growth. When it is too late for that, the weight of seeds is a good indication of their worth. The heavy seeds are usually more vigorous and give a quicker growth. Yet in the case of certain flowering plants, we reverse this order and select the weakest and smallest seeds. The reason for this is that the tendency of cultivation is to make the flowers double or the flower parts of large size; and this again dwarfs the seeds. Therefore, in selecting the smaller flower seeds, we may be getting the larger flowers. When we grow plants for foliage or seed development, on the other hand, we select the heaviest seeds, while in flower growing we often prefer the lightest, for the weakest plant often produces the finest flowers, though quite unable to produce fruit.

Three requirements for the germination of seeds are: Oxygen, moisture and heat. Certain seeds will germinate with less air than others; but, as a rule, a packed clay soil prevents good germination. Take two wide mouthed bottles and fill with peas, covered by water. Cork one bottle and leave the other open. The seeds in the open bottle will germinate freely: those in the corked bottle will merely make a beginning, or will fail altogether. This shows that air is necessary for successful germination. The soil therefore must be worked up, and made loose and open by plowing or spading, before it is planted.

Moisture.—All seeds need moist soil, but not free water. Capillary moisture, the moisture that clings to the soil grain, is what is required. Free water makes the soil too cold. By mulching the soil, or making it loose on top, the moisture will be prevented from evaporating. But the seed must not be loose in the soil. The soil must be packed close to it. This can be odne by stepping upon the planted seed bed; the bardener's best tool is his foot. By packing the soil about it the seed is supplied with the capillary moisture that clings about the soil grains. On a farm the packing is done by a roller that follows the seed drill, and the mulch is formed by sweeps or rakes attached to the seed drill to loosen the soil on top. After packing the soil, therefore, we must rake and loosen the surface layer. This lessens evaporation and keeps in the moisture.

Heat. Seeds require heat in order to germinate. As to the heat required for germination, some weed seeds will germinate between two blocks of ice. Ordinary garden beans might rot rather than grow if planted verly early. But lettuce, cabbage, peas, and radishes, are more hardy and can be planted as soon as the ground can be made ready. The seeds to be sown in the garden will require temperatures varying with the seeds used, but averaging about 70 degrees F. for best results. Most of the annual flowering plants cannot be safely planted outside early enough to insure an early summer bloom, therefore they should be started indoors in boxes. This is the case with most of the common flower seeds.

Uniform Conditions.—One of the most important principles in horticulture, is to keep the seeds under conditions nearly uniform. Plants are like ourselves. If first we eat candy, them omit a meal, then overfeed, we shall not thrive. So the plant, if it is now warm, now cold, now moist, now dry, will become sickly and lack color. The region at which the feeding takes place is just behind the tips of the smaller roots. By growing in the house and then transplanting we get better root system. For when we cut off the tips of the roots, the latter will branch and make a mass of root growth. **Transplanting** to the garden thus develops the roots and insures good growth, but it must not be done until the season is far enough advanced to insure uniform conditions. For indoor culture, use a good garden loam, one part, and sand one part. The sand admits air, but lacks fertility. Therefore we add one part of rotted manure, so far decomposed that it resembles leafy soil. This gives to the soil fiber as well as fertility. The average school ground is solid and needs deep spading and manuring before transplanting the seeds from the boxes to the garden. In using the **window boxes**, fill them with the mixed soil, pressed down by a board that fits into the box; plant the flower seeds under the smallest layer of soil, or in the case of petunias and other small seeds, do not cover them at all. But cover the soil with a piece of perforated paper, so that in pouring in the mater the soil will not be washed away. All seeds must have some covering and the moist paper often serves this purpose. The soil must not be allowed to become dry. Water the box every day, but after the plants come up, keep the soil dry on top by loosening it after irrigation.

Good Seeds.—The amount of seed to sow is not capable of demonstration in advance. The best plan is to sow heavily, so that if a considerable number fail, there will still be sufficient. Buy seeds from reputable seedsmen. Most seeds should have a pedigree. Seeds grown here would not necessarily grow elsewhere or even here. Thus, in the case of bulbs, those from the low countries of Europe are the best, though they often look inferior. Those grown in this country are likely to fail.

Sweet Clover.—Our farmers may yet profit by the use of sweet clover as a mulch and green manure. It is used in the hills of northern Kentucky to restore badly eroded tobacco lands and similarly in northeastern Iowa. In the far West it grows in profusion on the banks of irrigation ditches, sometimes in deserts where the soil is so alkaline that other plants will not thrive. Throughout the world the large areas of sweet clover are usually to be found on soils very limy (calcareous), showing the same fondness for lime that is common to all clovers and alfalfa. The most luxuriant growth is associated with lime, either as a part of the geological formation, as a result of glaciation, or as accumulation from the sedimentary deposits from the flood waters of streams having their source in limestone areas. Lime is abundant in nearly all Rocky Mountain soils, so that no treatment of the soil is usually necessary to make alfalfa or sweet clover thrive. In Kentucky, where a century of abuse had resulted in a sadly depleted soil and deeply gullied hills, sweet clover was accidentally introduced about twenty years ago. Upon plowing up an old field that had been "taken" by sweet clover, a "bumper" crop of tobacco was secured. Other badly washed areas have been converted into profitable pastures; the sweet clover making the conditions favorable to blue-grass after a few years. Great "scars" in the hills have been healed by it. Hundreds of acres have been and are being reclaimed by the use of sweet clover as a mulch and as a crop to plow under. Animals may refuse it at first, but all kinds of livestock learn to like it, and it does not differ greatly from alfalfa in its food value.

The Cabbage.—Next to importance to the potato comes the cabbage. It is now almost universally grown. It has been used for food from time immemorial over western and southern Europe. All the types—cauliflower, Brussels sprouts, collard, and kale, have sprung from the original source, the Linn. On the chalk cliffs of the English channel, the wild type is still growing. There are three distinct types of head, round, oval and flat. Some varieties are distinct, while others partake of two or more shapes due to crossing in seed production. There is much variation in the shape, color, character, and texture of the leaf, ranging from regular, straight edges, almost white, smooth and tender, to irregular, almost fringed edges, dark purple color, and coarse, tough texture.

Practically all varieties are hardy, but there is some variation in hardiness. Usually the purplish green varieties with crinkled and fringed leaves are hardier than the whitish green sorts with smooth, regular leaves. The cold-resisting varieties are also the most heat resisting. For an early crop, seed may be sown in a well prepared bed outside in September, and the plants may be wintered in a cold frame or by mulching with straw in a sheltered place. These plants may be set out early in the spring. For early crops from spring grown plants, the seed may be sown in hot houses or green houses in February or March. In four or six weeks the plants may be transplanted and set out of doors. When pulled, the roots should be dipped in thin mud to keep them moist until planted. Land on which cabbage is grown should be well drained.

"**The Quails** of the United States are now in their most interesting mood. One can travel thousands of miles and hear these winsome creatures calling familiarly through the fields. Where protected they make almost a house bird, not seldom getting as familiar as the hens, and eating with them in the barnyards. There are seven species, distributed from Texas to Oregon, and all up and down the Pacific. The peculiarity of the quail is its gleaning habits. It is found everywhere in Eastern grainfields, but nowhere is it complained of as doing any damage. If its crop is full of wheat, it is almost invariably from gleaning the waste. At the same time it gathers an enormous amount of weed seeds, and for this reason alone should be cared for by the farmers. In our southern states particularly Bob White has laws to protect him, wherever the farmer cares to have him protected. Clearly written signs posted about a ranch will prevent his being shot, in season or out. During the open season, however, the qual comprehends his danger, and keeps very close. Somehow he finds out during the closed season that he will be safe near houses. The nests are frequently built in orchards, and contain twelve to fifteen eggs. Among the insects most frequently consumed by Robert are the destructive mountain locust, the chinch bug, the Colorado potato beetle, the cotton weevil, the army worm, and a good many more of the worst pests that the farmer has to contend with; this in addition to the weed seeds that he devours. Through the western states you will find the quail in the cornfields late in the season, and not seldom spending all night there. We wish the farmers of America could comprehend the immense value of this bird, or rather fowl. The absolute protection extends in Colorado as far as to 1920. Thirty-one states require hunting licenses from non-residents. Very interesting experiments are being made in domesticating this bird. He is very fond of human attention, when it is not crowded too far. His food from October to March is very closely vegetable; and from then on the insect proportion increases. Grain forms a less prominent part of the foad at all seasons. Later in the season, seeds dominate, but the very slightest toll is levied on standing grain. Corn enters somewhat into his rations, as also wheat, with some sorghum and buckwheat and barley and oats and rye. All testimony goes to prove that the quail does us very little damage as compared with the very great protective power which he displays."—E. P. Powell.

Small Lizards.—There are sixteen species of swifts in the Plateau region—small lizards which run about the rocks as you approach, and, as their name indicates, run so fast that they are very difficult to corner. They are generally gray or brown and all live on worms, insects, and other things of little or no use to man. Stansbury's Swift (Uta stansburiana) is dark green or grayish, 4¾ inches long. The Ornate Swift (Uta ornata) is gray with wavy black bands, and from six to eight inches long. There are some 35 Spiny swifts (Sceloporus) in North America, though only a few of them ever come north to the United States.

Horned Lizards are called horned toads, despite the fact that they do not belong to the toad family. A peculiar habit they have is to emit a hair-like stream of blood from the corner of the eye when unduly handled. The tiny stream will extend for four feet or more, and it leaves the eyes of the creature swollen and closed. Horned toads do an immense amount of good in that they feed on insects. The Douglass horned lizard (Prynosoma douglassii) is about 5⅛ inches long and is the exact color of the gray mountain side. The Regal (Prynosoma regale), length 5¼ inches, is brown above and yellow below, and is found in the Gila and Colorado deserts. The Smooth-horned (P. platyrbinum) is found in the desert regions of Utah, Arizona, Idaho, and California. It is pinkish or brownish gray, and has a large dark patch on each side of the nape. Its back is marked with dark, wavy cross-bands. This is our comonest species, 5 inches long.

The Gila Monster (Heloderma suspectum), of Arizona and New Mexico, the only lizard in the West that we need fear, is about 19 inches long. It is marbled black and some pale hue, as pinkish or yellowish. It is remarkably agile, and once its jaws are fastened on your fingers, they must be pried apart. Even if the body be cut in two, the jaws, with fiendish persistence, continue the grip of death.

The bite is poisonous. In the regions in which this horrid creature occurs, its general appearance is well known.

Snakes.—We have many snakes in the West, but only one, the rattlesnake, is harmful. Our water snakes and field snakes all do good in that they feed upon mice, insects, and other pests. Never kill a snake unless you are in a rocky and mountainous country and you see one making a rattling sound not unlike the stridulation of a cricket. The number of rattles is not an indication of the age, since old and huge snakes have at times only one or two rings, and a variable number are added each year. The greatest number of rattles ever found on one snake was twenty-five. A rattlesnake's tail makes 75, and the rattles 110, vibrations per second. The purpose of the rattles is probably to call the sexes together, not to decoy birds by imitating locusts, nor to warn man. Thus, three snakes came to the assistance of one being attacked by a hog, when they heard the sound of its rattle. Some report having seen birds charmed by snakes, but so scanty is the evidence that no definite conclusion on the matter has yet been reached. The young of rattlesnakes are brought forth in numbers varying from nine to twelve; and, curiously enough, the young wigglers run down their mother's throat when in danger. The snakes are immune to their own poison; if they do bite each other the injury done is merely passing in nature. In winter rattlesnakes hibernate together. We are informed that in early days, 775 were killed in one day in Humboldt county, Nevada, by 600 miners.

THE LARGER WESTERN LIZARDS.

The Desert Iguana (Dipsosaurus dorsalis), or Keel-backed lizard, is easily distinguished by the row of keeled scales along its back. It is about 11½ inches long, and has a tail so brittle that it readily breaks off when grasped by the hand. The Chuckawalla lizard (Sauromalus ater), of the desert region of the southwest, is the largest except the Gila monster, being one foot in length. It is dull brown above, and rusty red, dotted with black, below. It has a large head and a flat tail. The Collared lizard (Crotaphytus collaris), about one foot in length, has a double black collar around the neck, and a yellowish, pale gray, or bright green body. It is found from Arkansas to eastern California and from southern Idaho to Mexico. It is very pugnacious and will eat its own kind, or even attempt to swallow a horned toad or snake as large as itself. The

Leopard (Crotaplytus wislizenii), a foot long, has a narrow head and a long tail. It is yellowish-brown with large, rounded, black or brown blotches. Numerous brick-red dots appear between the blotches, and pale lines across the back. It is found almost exclusively in the Great Basin. The Zebra-tailed (Callisaurus draconoides), length 5⅝ inches, has a small, flat head and a body of gray color, dotted with white and two rows of V-shaped blotches on the back. Its abdomen is white with a bluish patch at each side.

OREGON GRAPE (Berberis repens).
An evergreen—a substitute for holly—a low, creeping shrub with bright yellow flowers.

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